

THE CITRUS INDUSTRY IN MEXICO:
ANALYSIS AND PERSPECTIVES

By

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TO MY FAMILY ALEJANDRA, ADRIAN, AND ROSA ISELA

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Major Department: Food and Resource Economics

The United States and Mexico are the second and third largest orange producers in the world, respectively. As such, it is not surprising that issues related to trade in fresh and processed oranges were among the most contentious in the North American Free Trade Agreement (NAFTA) negotiation process. In this dissertation, the orange production/consumption sector in both countries is described. Competition between the two countries is analyzed in the context of a model of the world orange juice market. The prospects for increased trade in orange products is considered as the provisions of NAFTA are fully implemented.

The overall objective of this dissertation is to provide an analysis of the market for fresh and processed oranges in the United States and Mexico. This is accomplished by describing the existing market in both countries. The descriptive analysis is used as a basis for the development of a quantitative model of the processed orange market in the United States and the fresh and processed orange markets in Mexico

The processed orange industries of Mexico and Florida are discussed with reference to NAFTA. A scenario is analyzed via a spatial equilibrium model on the impact of increased Mexican imports to the United States, as orange juice tariffs are phased-out.

Before and after the implementation of NAFTA, the economy in Mexico has been constantly transformed. This dissertation analyzes the major economic changes implemented during the last ten years in Mexico. The analysis is presented in a descriptive form, describing the behavior of the most important macroeconomic variables in the Mexican economy.

CHAPTER 1 INTRODUCTION

The importance of the citrus industry in Mexico is unquestionable. The total acreage and production corresponding to this agricultural commodity place it among the most significant crops in the country. Citrus also represents one of the main labor markets. The diversity of citrus species found throughout the country is significant and today most are commercially exploited.

One aspect making the citrus industry so important is production of oranges. With more than 25 percent of the total fruit acreage and production, and domestic per capita consumption of almost 80 pounds per year, oranges represent the most important fruit produced and consumed in Mexico (Apoyos, 1999). After the freezes that visited Florida in the 1980's, relocation and an expansion of orange production took place in Mexico. During the 1950's the area of Montemorelos in the state of Nuevo Leon (NL) was the center of production. The freezes that affected production in Florida also affected an entire region in Mexico, serving to stimulate rapid expansion of the production in the southeastern part of the country, especially in the states of Veracruz and San Luis Potosi (Figure 1.1).

Today the production of oranges in Mexico is spread over the entire country, but Veracruz is the major producer with 45.2 percent of the total area planted in Mexico and accounting for 40 percent of the country's total orange production (Secretaría de Agricultura, Ganadería y Desarrollo Rural, 2000). The municipality of Alamo, in the state of Veracruz, holds major importance in terms of land area devoted to oranges and volume

of orange production. In this area 95 percent of the citrus land is planted with Valencia oranges but many other species of citrus varieties are found to share the area planted. Other relevant areas in Veracruz are the municipalities of Gutierrez Zamora and Martinez de la Torre, with the latter being the second largest producer after Alamo, which is dominant in the Persian lime market. The prevailing orange variety in this zone is Late Valencia. It is also intercropped with grapefruit, tangerines, limes and many other agricultural commodities.¹



Figure 1.1. Mexico. Main orange producing regions

In Veracruz, as in the other producing zones in Mexico, almost 90 percent of production is geared to the fresh domestic market. Oranges in Mexico, and particularly those from the state of Veracruz, are infected with the Mexican fruit fly (*Anastrepha*

¹ Intercropping is a common agricultural practice in Mexico's orange industry. Repeatedly, this fact has been blamed for the low citrus yields reported in the state of Veracruz.

ludens (Loew)), which bans the possibility of export to the international market. Only the states of Sonora and Sinaloa in the northern part of the country are considered fruit fly free zones and are allowed to export fresh oranges to international markets. The remaining 10 percent of production is allocated to processing plants to be transformed into orange juice destined for international markets. Consumption of processed orange juice in Mexico is relatively small as most of the orange juice consumption is as orange juice squeezed at home.

The Processing Sector in Mexico

Emergence of the citrus processing industry in Mexico is relatively recent. The first two processing plants were established in Montemorelos, NL, during the early seventies, which at that time was the most industrialized orange production region. In 1980 there were 9 processing plants in Mexico and by 1990 this number was 28. Processing capacity grew more than 200 percent over the period, stimulated by the freezes in Florida and the financial support provided by the Mexican government through the national bank. Given the considerable importance of the fresh domestic market in Mexico, however, the processing sector normally has been reduced to a second order, causing processors to experience some difficulty in anticipating their levels of production and in maintaining a regular stock of product. This situation has favored a new structure within the industry where processing plants are tending to be integrated with the primary sector. More processing plants are backward vertically integrating into citrus production. They are also more involved in production research headed to improving the production yields.

Even with the predominance of the fresh market, the processing sector in Mexico reached significant levels of production during the early 1990's, spurred by the shortage of orange juice supply from Florida that occurred after the freezes. During this time,

installed capacity in Mexico skyrocketed in just 5 years. Today the industry is reduced to a few processing plants concentrated in the southeastern part of the country, reducing the installed capacity by 75 percent compared to 1995. As mentioned before, consumption of processed orange juice in Mexico is insignificant so export to international markets has become a very important target for Mexican citrus processors.

Trade Agreements

Mexico has more trade agreements than any other country in the world (Table 1.1). Since 1992, the Mexican government has been involved in a process of trade liberalization. Eleven trade agreements have been signed involving 32 countries in three continents, implying a potential market of 850 million consumers. In almost all of those markets, orange juice has been meticulously considered in order to guarantee a market for Mexican production. The North American Free Trade Agreement (NAFTA) is the most important agreement in terms of product scope, the dimension of the markets and the advantage of proximity to the United States. Furthermore, the United States and Canada, the two countries participating in NAFTA along with Mexico, are both major consumers and importers of orange juice, although the United States has reduced its dependence on imports in recent years.

Another important trade agreement is that signed with the European Union in 2000, which includes 15 countries in Europe, all of them with significant levels of orange juice consumption. This is the biggest market in the world and it represents the second largest trading partner for Mexico, after the United States, with a value of imports of 850 million dollars per year. This agreement is new and a significant impact cannot be determined yet but it should represent a tremendous opportunity for Mexico. Trade agreements like the one signed with Israel also in 2000 are expected to create a significant impact for the

Mexican economy given its unlimited access to many commodities, including fresh oranges and frozen concentrate orange juice (FCOJ).

Table 1.1. Mexico. Trade agreements

Year	Trade agreement
1986	General Agreement on Trade and Tariffs (GATT)
1992	Economic Complementation Agreement (ECA) with Chile upgraded to the category of Free Trade Agreement (FTA) in 1999.
1993	Asian-Pacific Economic Cooperation (APEC).
1994	North American Free Trade Agreement (NAFTA).
1995	FTA with Costa Rica, Bolivia and the Group of 3 (G3): Colombia and Venezuela.
1998	FTA with Nicaragua.
2000	FTA with the European Union and Israel.
2001	FTA with the Northern Triangle: Guatemala, Honduras and El Salvador.
2002	ECA with Uruguay. FTA with the European Free Trade Association (EFTA).

Source: Secretaría de Economía, 2002

More recently, the congress in Mexico started reviewing the approval of a new trade agreement with the European Free Trade Association (EFTA) that includes the countries of Iceland, Liechtenstein, Switzerland and Norway. Three other agreements are anticipated before the end of 2003, converting the so-called new government of Vicente Fox into the most aggressive administration in terms of international trade.² Current trade talks and negotiations are well under way with Singapore and Japan.

Problem Statement

For many years, the main idea supported by literature concerning the orange industry in Mexico encouraged expansion of the industry based upon an inappropriate appreciation of the perspectives for Mexico within the world market. As a consequence major investments in the citrus industry in Mexico led the sector to problems of overproduction as well as under utilization of processing capacity.

² Vicente Fox has governed Mexico since December 2000, after the Partido Accion Nacional (PAN) replaced the Partido Revolucionario Institucional (PRI). The PRI was in power for more than 70 years.

During the 1990's several sources mentioned the prevailing low utilization of installed capacity in the processing sector (Gomez Cruz and Schwentesius Rindermann, 1994). As an immediate response to this under-utilization problem, the Mexican government implemented a financial policy based on easy credit, allowing the development of new orange plantations in order to increase production. Ten years later, many processing plants abandoned the industry because their lack of supply was not solved; additionally, the market was affected by an historical overproduction. During the 1980's several devastating freezes visited Florida destroying a large proportion of its orange plantations. This fact spurred a major expansion in production of orange juice in Mexico with the idea of complementing the lack of production in Florida. The government in Mexico devoted many resources to encouraging the establishment of new processing plants. The processing industry grew by 200 percent, moving from 8 established plants to 24 plants in 1993. A program aimed to satisfy the input requirement for processors never accompanied this structural change within the processing industry. Furthermore, this policy never considered that the citrus industry in Florida would recover within a few years.

Thus, both lack of planning and the omission of an internal marketing strategy to ensure production continuity effectively contributed to the recent declining trend that the Mexican industry is confronting. Today, the citrus industry in Mexico is characterized by a dichotomy: it represents one of the most important agricultural products in terms of the planted area and consumption but it is enduring a situation of becoming less important both at a domestic and at international level. The processing sector has been dramatically reduced and today there are only 12 processing plants operating in Mexico. Why did the

industry fail to maintain itself as a competitive one? What are the factors that negatively affected the development of the citrus industry in Mexico?

The geographical position of Mexico and NAFTA are specific conditions that should favor the allocation of Mexican orange juice to the U.S. market. The structure of the orange industry in Mexico has limited its participation in the North American market to the extent that Mexico acts as an “emergency” supplier for the U.S.

The inability to plan juice production and the inconsistency in the quality of orange juice produced have resulted in a progressive loss of potential comparative advantage that Mexico could achieve in the international market.

Exports of Mexican orange juice to the United States have remained unaffected by the favorable presence of NAFTA. Instead, for some years, they have even decreased. Mexico’s participation into the U.S. orange juice import market started to grow in 1985, reaching a level of almost 15 percent in 1991. A shortage of orange supply that occurred in 1991 reduced this level to only 3 percent in 1992. Yet after 1992, Mexico regained its presence in the U.S. market, motivating the tariff rate quota schedule that later would be implemented under NAFTA.³ One year after NAFTA was implemented in 1994, Mexico reached a record high participation level of 36 percent. This participation, however, has been better explained by the economic devaluation that occurred in Mexico on December of 1994 (see Chapter 2). Since 1998, Mexico’s participation in the U.S. orange juice import market has been decreasing, reaching levels similar to those experienced during the early nineties (Figure 1.2).

³ Chapter 4 provides a detailed explanation of the U.S. tariff rate schedule for imported orange juice under NAFTA.

The processing sector in Mexico still can be considered underdeveloped since it has not yet found either domestic or export markets for orange juice large enough to increase processed utilization of oranges.

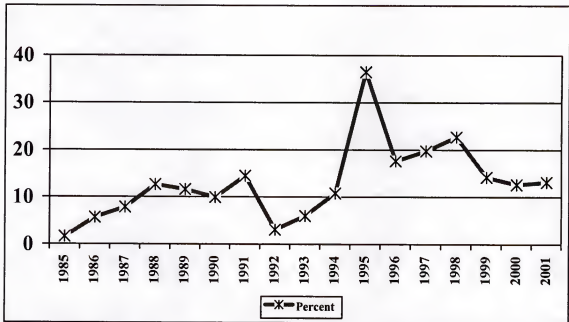


Figure 1.2 Mexico. Participation in the U.S. orange juice import market, 1985-2001

A severe limitation for the industry, especially for the processing sector, is the poor coordination between growers and processors. The processing sector is a residual buyer of low quality oranges only after the fresh market is satisfied with better fruit.

Objectives

Considering the problem stated in the previous section, this dissertation has the following objectives.

- To analyze the past and current citrus industry situation in Mexico in order to provide a better understanding of the structural changes occurring in the industry within recent years.
- To describe the current economic situation in Mexico and the changes that occurred after the social and economic crisis of 1994. The objective here is to emphasize the major transformations made to the agricultural sector in Mexico and to the citrus industry in particular. The analysis is based on the review of the policies

implemented after the crisis and the behavior of the main macroeconomic variables in the Mexican economy.

- To measure the impact of NAFTA on the U.S.-Mexico orange juice trade relationship.
- To forecast the international position of the Mexican citrus industry under the tariff schedule established by NAFTA. That is, to predict the pattern of trade for Mexico considering the tariff elimination in the U.S. market after a period of 15 years as considered in the trade agreement.
- To determine the way the market for citrus is organized in Mexico. This part of the analysis reviews the characteristics of different marketing mechanisms and its economic implications in terms of price risk and production.

Scope of the Analysis

The present analysis refers to those elements that have a direct effect on the citrus industry in Mexico, in particular, the orange juice processing sector. In this respect, the analysis considers the domestic economic situation, as well as land tenure, as primary determinants of orange production in Mexico. This economic situation has been a key element in determining Mexico's participation in the world orange juice market. The increasing trade relationship established between Mexico and the U.S., for instance, has made the exchange parity peso-dollar act as an important variable affecting the volume of orange juice trade between these two nations.

On the other hand, land tenure is considered one of the most important elements affecting orange production in Mexico. Land tenure has provoked land fragmentation and retarded capital investment in the Mexican agriculture. Orange production is directly linked to the orange juice processing sector as its main input.

In the international arena, orange juice price and the demand levels for orange juice in international markets simultaneously affect orange juice production in Mexico. Production from Brazil and the U.S, mainly determines orange juice international price.

These two countries, and particularly the states of Sao Paulo in Brazil and Florida in the U.S., account for almost 90 percent of orange juice production in the world. Mexico's modest share in the world market, confines it to act as a price taker. Consequently, Mexico's orange juice production is, in some way, determined by the performance of the industries in Brazil and the U.S.

Processed orange juice consumption in Mexico is not significant. Mexicans prefer to squeeze fresh oranges at home, reducing the possibility of developing a strong domestic processed orange juice market. For this reason, this analysis is focused on international markets; in particular, to the U.S. market in the context of NAFTA, Mexico's most important export market. Although new markets are developing for Mexican orange juice in the European Union and Asia, its NAFTA partners still represent the most prominent market.

Finally, this analysis studies the market structure of the processing sector in Mexico and its implications in terms of production and industry composition. The composition of the processing sector in Mexico has been in constant transformation since the beginning of the 1990's. A tendency to backwardly integrate with orange production is foreseen and this change may bring important changes in the structure of this sector.

Figure 1.3 presents the scope of this analysis in summarized form. Arrows indicate the direction of the effect created by each one of the elements surrounding the processing sector in Mexico. The analysis considers that market structure has a bilateral relationship with the processing sector.

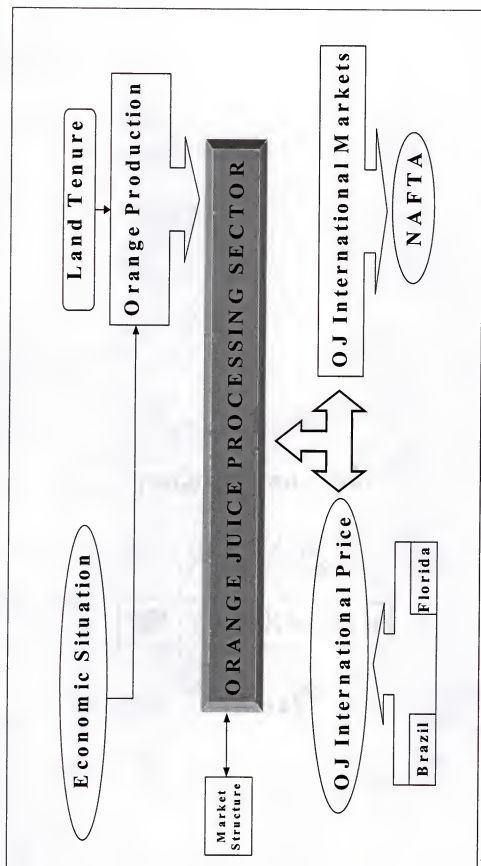


Figure 1.3. Scope of the analysis

Procedure

This research is divided into 5 chapters. The present chapter provides a descriptive background of the citrus industry in Mexico. Chapter 2 considers a description of the current situation in Mexico, both in terms of politics and economics as a context for analysis of the citrus industry. The main idea is to clarify the effects that the new political era in Mexico is creating at the interior of the citrus industry, and, in particular, the impact on the processing sector in a free trade and marketing context. In consequence, the chapter contains more than a simple description of the current scenario in Mexico. It also refers to an analysis of the macroeconomic variables that play a determinant role in the economy as a whole and in the citrus industry in particular. Among many other aspects, the economic review is referred to as an analysis of exchange rate variation and its effect on the orange juice trade flow from Mexico. The level of orange juice exports from Mexico seems to be strongly related to the peso-dollar exchange rate prevailing in the market. Most serious, the processing sector in Mexico currently confronts a situation of profound debt and a lack of capital flow that restricts its level of production. Although direct investment is on the agenda of the current government and Mexico has become the third-largest recipient of foreign investment among the so-called emerging markets (Huenemann, 2001), the results are still not visible. An analysis of the relationship between the interest rate and foreign investment is pertinent and necessary to provide some information on this matter.

Chapter 3 aims to analyze the market structure of the citrus industry in Mexico. One of the main problems of the industry is the poor coordination between growers and processors. Some of the remaining processing plants are backward vertically integrating into citrus production as a measure to overcome the uncertainty of orange supply. Thus,

some relevant questions emerge: What are the factors affecting and limiting improved coordination among citrus industry agents? Which forms of coordination, if any, are possible in the citrus industry in Mexico, given the current structure of the market? What are the specific implications of a vertically integrated citrus industry in Mexico?

Production of oranges in Mexico is characterized by a highly fragmented structure followed by market intervention and a very primitive marketing system. Land structure in Mexico, under the form of *ejidos* and the social benefits associated with land tenure, has never allowed a necessary restructure in terms of the land size. Since the government in Mexico provides social benefits tied to land that include aspects of healthcare as well as financial benefits, families divide one piece of land among their members so each one can enjoy the social benefits on an individual basis. This situation, together with the *ejido* structure, fragments orange production in Mexico so that several producers are needed in order to satisfy the requirements at the processing plants. By the same token, this situation interferes with the possibility of establishing any kind of contractual relationship between growers and processors. Fruit procurement in Mexico by processors is made on a daily basis because it is rare to find a grower who can satisfy the necessary amount of oranges needed by processors. Having several growers under the same contractual form is a cause of high transaction costs and risk.

The so-called marketing mechanisms are arrangements to procure fruit by processors. By these means processors anticipate production and establish quality controls that markets require. Marketing mechanisms are also a very effective way to deal with price risk. Among the most common mechanisms are cash, multi-year fixed price contract, participation and cooperatives. This chapter will analyze each one of these

options in terms of the advantages and disadvantages provided. The chapter will also consider an analysis of the price risk implications and the feasibility of implementing them in a citrus industry similar to that of Mexico.

Another part of the chapter refers to analysis of vertical integration in the citrus industry. Here the focus is on the particularities of integration, viewed as an incentive for firms to be profitable throughout the reduction of transaction costs. Transaction costs “refer to any expenditure of resources associated with the use of the market in transferring a good or service from one party to another” (Blair and Kaserman, 1983 p. 12). The importance of integration inside the citrus industry in Mexico is given by the potential of another product in the U.S. market: not-from concentrate orange juice (NFC). The alternative consumption of NFC in the United States represents an opportunity for Mexican producers, given the geographical location with respect to the U.S. market. Countries like Brazil, and those from the Caribbean Basin Initiative (CBI) such as Costa Rica, Belize and Honduras, have higher transportation costs for NFC to the U.S. relative to Mexico. By 2008 Mexico will be treated the same as CBI countries, with tariff equal to zero for all categories of orange juice. If Mexico is capable of maintaining a constant level of production and quality, a major opportunity can be given to the industry. Since that production of NFC requires a significant investment in storage, it is assumed that integration is a necessary element for the industry to succeed.

Finally, it is necessary to analyze the structure of the citrus market in Mexico under the perspective of middlemen participation. The presence of “coyotes” in the market chain creates a disturbance in the market by reducing the participation of orange growers in the marketing channel. Coyotes are an important part of the citrus industry in Mexico

but their contribution to the production process is still questionable. This analysis will entail a comprehensive description of their role and will try to determine whether they are necessary or not in the Mexican citrus industry.

Chapter 4 contains a prediction of the world orange juice market situation and the role of the Mexican orange juice industry in the context of NAFTA. This prediction is accomplished by the use of a quadratic programming model previously designed by McClain (1989) and McCarl and Spreen (1980). In spite of replicating a model that has been previously utilized, the major contribution of this chapter is the incorporation of Mexico as a world player inside the international market for orange juice. Currently Mexico ranks as the third major orange juice producer after Brazil and the U.S. The model takes into account the tariff schedule within the NAFTA negotiations and incorporates the supply of Mexican orange juice to the U.S. market, the most important market for Mexican orange juice. The final model is a combination of a spatial equilibrium model with an assembly model.

Conclusions and recommendations based on the research are provided in chapter 5.

CHAPTER 2

THE ECONOMIC SITUATION IN MEXICO

The existing economic disparities between Mexico and its trading partners within the North American Free Trade Agreement (NAFTA) were an open concern during the negotiations and even after the agreement was finally implemented in 1994. This unique initiative was often questioned because of the involvement of two of the most powerful economies in the globe, Canada and the United States (U.S.), with a gross domestic product (GDP) per capita of \$20,000 and \$26, 000 respectively, and the inclusion of a developing country whose GDP per capita was equivalent to \$2,500 (de Ita 2000).¹ In addition to this income gap, there were also sharp differences between the corresponding technological levels, factor endowments, labor productivity rates, different institutional structures and, of course, different ways to conduct the economic destination of each one of the implicated countries (Russell, 1994). These economic--and up to a certain point, natural--disparities, however, in no way restrict the effects that a given economic situation in one country may have on the others. This was proven beginning in late 1994 when Mexico had one of its worst economic debacles of all times.

The series of combined macroeconomic variables that resulted in the historic devaluation of the Mexican peso against the U.S. dollar provoked a reversal in the growth of exports from the U.S. to Mexico in 1995 (Figure 2.1). It was acknowledged then that a trade surplus with one country through an increase in exports almost always results in

¹ According to the 1995 peso-dollar exchange rate.

more jobs created in the economy--unless imports substitute for more labor than exports create. The United States Department of Commerce (USDC) showed in 1994 a relationship between the number of jobs created and a trade surplus. USDC estimated that 20,000 new jobs are created for every billion dollars in trade surplus (United States Department of Commerce, 1994). It is not surprising then that when the U.S. was negatively affected by the economic crisis in Mexico, the U.S. government decided to help stabilize the Mexican economy through the transference of dollars.

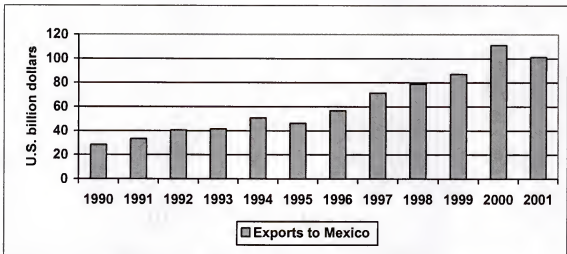


Figure 2.1. U.S. exports to Mexico, 1990-2001.

The maintenance of stabilization in each one of the economies integrated in the trade agreement has been paramount for the success of the bloc. This explains, in good part, why Mexico's NAFTA trade partners contribute to its economic growth, help to prevent economic instability, participate in economic recuperation, and promote growth in incomes based on agricultural development in Mexico.² Integration of the Mexican, Canadian and U.S. economies has been such that even internal political events have a repercussion on the others. Government transitions and political campaigns place some

² Intra-regional agricultural trade between the U.S., Canada and Mexico has significantly grown since the implementation of NAFTA in 1994. To date, agriculture represents the third major category in exports from Mexico to its NAFTA partners, after manufactures and oil & minerals (Secretaría de Economía, 2002).

degree of uncertainty at the domestic level that consistently affects the overall trade relationship.

For these interdependent reasons, analysis of the economic situation in Mexico for the last decade is important. The justification for such analysis is based on a need to understand the economic reasoning leading to the current situation found in the citrus industry in Mexico and the agriculture sector in general. One goal of this chapter is to demonstrate that the economic situation in Mexico is a consequence of a broad economic and political events occurring during the past decade in and among the NAFTA countries. The analysis briefly refers to the macroeconomic variables that play a role in explaining some of the trade relationships among the three participating countries.

The Mexican Economy, 1994-2000

For better understanding, management of the Mexican economy by President Ernesto Zedillo Ponce de Leon can be divided into two periods: the Program of Adjustment and Stabilization (started in January and February of 1995) and the National Program to Finance Development, initiated in 1997. The first program was an urgent and desperate plan to recover a deteriorating Mexican economy whose financial problems were threatening the viability of future economic development. The second one was a plan to avoid the recurrence of a similar crisis. These two programs help to characterize the six-year period of the Zedillo government with an economic policy based on structural change, economic aperture and deregulation, with the primary purpose of reducing inflation while permitting economic growth. The social cost, however, was high and the macroeconomic strengthening program generated more poverty and economic disparity within the Mexican people (Salinas de Gortari, 2002).

Historic Background

Between 1950 and 1970 the Mexican economy experienced notable performance. During this period, GDP per capita grew between 3 and 4 percent per year with an average inflation rate close to 1 percent. These years were called the period of *Desarrollo Estabilizador* (stabilizing development) of the Mexican economy, and it was a time where industrialization and modernization took place under a model of import substitution (Organización para la Cooperación y el Desarrollo Económico, 1997). Due to important changes in economic policy during the seventies, the economy became more vulnerable to external conditions. Two balance of payments crises occurred, one in 1976 and a more severe and prolonged one in 1982. Subsequent governments opted for the globalization of the country. All of these administrations attempted to enter into a world subject to the rules of competitiveness. Consequently, at the beginning of 1988 and during the government of president Zedillo, the prevailing theoretical criterion was the *neo-liberal* policy, which was the abandonment of populist economic projects and whose main objective was the reconstruction of the government (Rubio, 1998).

According to the neo-liberal philosophy, the fundamental objective of the economic policy is to cause flexible functioning of the market, eliminating all barriers to free competition. This theory conceptualizes the world as a large market in which all participants compete under the same conditions. This fact assumes complete exposure of the domestic economy to international competition, adoption of a flexible exchange rate and the elimination of all forms of trade protection and subsidies including all economic incentives to producers.

Beginning with the government of president Miguel de la Madrid Hurtado (1982-1988), Mexico began initiating conditions that ended with the implementation of policy

realignments for trade liberalization and initiation of modernization in production, providing industry with the best technology available (Unidad de Análisis Prospectivo, 1993). The idea was to be more competitive and to support the entry of Mexico into the international economic arena.

After 1987 the government finally began to make progress against inflation. Prevailing price instability had severely upset economic expectations, discouraged much-needed investment, and delayed the country's economic recovery. In an effort to restore price stability, government policy makers decided in late 1987 to stop devaluing the peso at rates equal to or higher than the inflation rate (Castro Escudero, 1993). More importantly, in December 1987 the government forged a joint agreement with the leaders of labor, peasant, and business sectors to restrain wages and prices. This accord, known as the Economic Solidarity Pact (Pacto de Solidaridad Económica--PSE), promised to reduce Mexico's monthly inflation rate to 2 percent by the end of 1988. The PSE required further reductions in public spending and credit, higher tax revenue, and a tighter monetary policy. All were intended to reduce the fiscal deficit and control inflation. The new revenue measures included an increase in the value-added tax (IVA), a new personal income surtax, and elimination of tax exemptions (De la Madrid Hurtado, 1987). The government raised prices of public goods and services, and allowed interest rates to rise in order to promote saving and reduce capital flight. The PSE also included a structural adjustment component emphasizing trade liberalization and privatization of state enterprises.

The plan soon produced results. The inflation rate fell considerably, living standards recovered slightly, and economic growth resumed. Annual inflation fell from

159 percent in 1987 to 52 percent in 1988. The gradual recovery of Mexico's international reserves in 1989 and 1990 allowed the government to sustain a credible fixed exchange rate and finance deterioration in the external account caused by the tariff reductions. Jose Reyes Heróles, a political analyst in Mexico, commented about President De la Madrid and the PSE: "Although President de la Madrid was himself not highly popular as he approached the end of his six-year term, his government had sufficient authority and institutional strength to enforce the wage restraints included in the PSE" (Reyes Heróles, 1992 p.xii).

The period of President Carlos Salinas de Gortari started in 1988 in an economic situation in which deterioration of purchasing power was predictable. Anticipating possible overturn of de la Madrid's policies, President Salinas announced in January 1989 a new version of de la Madrid's PSE, called the Pact for Economic Stability and Growth (Pacto para la Estabilidad y el Crecimiento Económico--PECE), which he hoped would end Mexico's net capital outflow (Secretaría de Gobernación, 1993). Salinas's economic program received considerable external support. In March 1989, Mexico and the United States reached agreement on a long-term plan to restructure Mexico's 52.7 billion dollars debt owed to commercial creditors. The plan, proposed by United States Secretary of the Treasury Brady, was intended to attract new foreign investment, encourage return capital, reduce domestic interest rates, and foster higher growth (Devlin and Lustig, 1990). With this policy, Salinas' presidency was identified as a fusion of neo-liberal policies and the social policy of his predecessor (Russell, 1994). The objectives of the PECE are summarized in Table 2.1.

During Salinas' administration, the PECE was reformulated in several of its objectives including prices, wages, foreign exchange and public finance. Trade liberalization within this period was accomplished through a transitional process that reduced employment with the idea of increasing productivity and technology adoption (Reygadas, 1991). A severe crisis in the banking system provoked by liberalization of the financial system also occurred. Recovery of public finances created a serious problem of credit absorption in the private sector. Consumption increased considerably due to reductions and elimination of import tariffs as well as the ease of obtaining credit, supported by external savings. This movement increased the current account deficit.

Table 2.1. Objectives of the Pact for Economic Stability and Growth (PECE)

Stabilization policy	General objective
Inflation	Consolidate the elimination of inflation.
GDP	Moderate but positive.
Fiscal policy	Directed to elimination of inflation and serving as a basis for gradual and sustained economic growth.
External debt	Renegotiate in order to reduce the transference of resources.
Public expenditure	Primary surplus would be almost 8 percent of the GDP.
Income policy	No increase in electricity, gasoline, and domestic gas prices.
Monetary-Fiscal policy	Be in agreement with the objectives of the program. Monetary expansion should be gradual and conservative.
Exchange policy	Eliminate the fixed exchange rate and a daily gradual devaluation of one peso from January 1988 till July 1989.
Wage policy	Increase minimum wage by 8 percent starting January 1st 1989.
Trade policy	Modify the structure of import tariffs in order to eliminate existing trade distortions.
Economic deregulation	Seek economic deregulation at the national level, in particular in the transportation and financial sectors.
Environment	Implement international standards to prevent deterioration.

The exchange policy helped to reduce inflation from 159.1 percent in 1987 to 7.1 percent in 1994. At the same time, the risk to foreign investors--who represented a significant inflow of capital--was eliminated. The increasing investment portfolio did not contribute to the formation of development projects that would satisfy the primary needs

of the country but left it in an exceptionally vulnerable position for the crisis to come in December 1994 (Ortiz Wadgymar, 1995).

On August 21 of 1994 elections were held in Mexico. Results favored Ernesto Zedillo Ponce de Leon who became president on December 1st. A few days later, on December 19th, the economic crisis exploded after a 100 percent increase in the interest rate on the internal debt. The Certificados de la Tesorería de la Federación (CETES), an economic instrument first offered by the federal government in 1985 to finance its activities, increased by 30 percent during the last week of 1994 and 40 percent during the first days of January 1995 (Banco de Mexico, 1995). This created an unprecedented devaluation of the Mexican peso. On December 20th, a 53-cent increase in the top limit of the exchange rate was approved, but the demand for dollars *shot up* and the day after, the exchange rate was on the order of 3.99 pesos per dollar, just 34 cents under the upper limit.³ This fact provoked the Mexican Stock Market to close operations with a loss of 12 percent. Due to the interdependence promoted by globalization, this type of financial crisis was to have similar effects in some other Latin America countries, being later known as the “*Tequila Effect*”. Given these conditions, the main challenge for president Zedillo was exchange rate recovery without affecting economic stability.

Causes of the 1994 Economic Devaluation

Devaluation of the Mexican peso in 1994 resulted from recognizable causes: the existence of a significant and growing current account deficit (i.e., an excess of imports over exports), over-expansion of the money supply, and over-reliance on short-term borrowing (Huerta, 1995).

³ In the Northern part of Mexico the exchange rate reached the level of 5.50 pesos per dollar.

Politicians in Mexico believed that the country's persistent current account deficits were simply the normal counterpart to large capital inflows representing foreign investment in what seemed to be a promising market (Gil Diaz and Cartens, 1996). From 1990 through 1994, however, direct investment in plant and equipment accounted for less than a quarter of the total inflows. The rest came from portfolio investment in equities and bonds, largely by mutual funds. Unlike direct investment, portfolio investment has great mobility and can be almost immediately relocated at more profitable markets.

As long as the capital inflow continued, however, Mexico was able to maintain the value of the peso and accumulate foreign exchange reserves of more than \$25 billion at the end of 1993. In 1994, however, the situation changed. The PRI presidential candidate, Luis Donaldo Colossio, was assassinated. The Zapatista uprising in the southern province of Chiapas heightened political tensions, and another assassination, that of reform-minded PRI-leader Jose Francisco Ruiz Massieu, as well as kidnappings of prominent executives, added to the political turmoil. The resulting uncertainty led many investors to take their money elsewhere. Meanwhile, in the United States, the Federal Reserve began raising short-term interest rates to combat inflation, providing added reward to capital fleeing Mexico (González Gómez, 1998).

The Mexican central bank facilitated the conversion of pesos into dollars by purchasing foreign-owned financial assets directly and by extending credit to the banking system. Had the central bank refused to take these actions, the sales of such assets would have caused their prices to decline and interest rates to rise, slowing the outflow of

capital. However, facing what was initially viewed as a close election, the Salinas administration opted for easy money and the central bank submissively complied.⁴

When the inflow of capital fell short of eliminating the gap between imports and exports, Mexico alternatively issued short-term domestic debt. To attract investors, the Mexican Treasury emitted an investment document called *tesobonos* (bonos de la Tesorería de la Nación or treasury bonds). These instruments were denominated in dollars and sought to maintain the stock of capital in the country. Zedillo would mention later that as foreign capital continued to flow out and the import surplus continued to rise, Mexico's dollar reserves decreased and the country was forced to enter the short-term money market more frequently (Zedillo Ponce de Leon, 1995a).

In the end, given its rising current account deficit and the political uncertainty that was keeping foreign investors away, there was simply no way Mexico could maintain both low interest rates and an over-valued peso. Only after its foreign exchange reserves were nearly depleted, however, did newly installed President Ernesto Zedillo opt for devaluation. On December 20, 1994, the government announced that the restrictive band within which the peso was permitted to trade would be raised 15 percent. Unfortunately, the announcement caught investors by surprise and the government without a plan for restoring fiscal discipline. As a result, with confidence collapsing, a speculative run against the peso ensued on the following day, and the nation's foreign exchange reserves fell by about \$6 billion in a few hours. Only then was the decision made to let the peso float, allowing market forces to set its prices.

⁴ In his book, *Mexico, The Policy and Politics of Modernization*, former President Salinas blames Zedillo's administration for releasing "privileged information concerning the imminent devaluation to a few Mexican businessmen, enabling them to exchange their pesos for dollars, exhausting Mexico's international reserves within only a few hours" (Salinas de Gortari, 2002 p.XXXVI).

According to Salinas, President Zedillo failed in his obligation to design an economic package, needed to stabilize the peso after the December devaluation. Salinas' statement is the following:

...Zedillo's government waited for three months to announce an economic package. Moreover, between the end of December 1994 and the beginning of March 1995, while the government team vacillated and zigzagged, interest rates rose explosively, and three more peso devaluation occurred. When, in March 1995, he finally announced the economic package, interest rates had already risen to nearly 110 percent, and the exchange rate had more than double, to 7 pesos to the dollar. With the brutal and sudden elevation of interest rates and the economic recession it engendered, hundreds of thousand of families lost their savings and thousands of companies went bankrupt. That was the social disaster produced by the December mistake. (Salinas de Gortari, 2002 p. XXXVI)

The Recovery Process

On January 31, 1995 President Clinton announced a \$51 billion assistance plan for Mexico that did not require Congressional approval. The aid funds, only \$20 billion of which came directly from the United States, were intended to help Mexico tolerate the immediate crisis by restructuring its debt to lengthen the average maturity as well to provide assistance to troubled banks (Banco de Mexico, 1996). Mexico's basic economic problem, however, was its need to reduce its dependence on short-term flows of money by cutting its current account deficit. Devaluation helped because imports became more expensive and exports became cheaper.

The austerity program, publicly announced on March 9, 1995 by President Zedillo, contained the following points:

- A value-added tax (IVA) increase from 10 percent to 15 percent;
- An increase in the price of gasoline by 35 percent, with additional 0.8 percent per month hikes throughout the rest of the year;
- An increase in the value added price of electricity by 20 percent; and,

- A 10 percent reduction in government spending by suspending planned infrastructure projects, laying off government workers, and reorganizing departments.

These measures were expected to virtually eliminate most of the current account deficit and stabilize the peso's value. But this progress came at a high cost. The government estimated at that time that in 1995 Mexico's output of goods and services would drop by 2 percent, 750,000 workers would lose their jobs, and inflation would still average 42 percent for the year (Zedillo Ponce de Leon, 1995b). The resulting outcome was even worse and the private sector revealed that about a million jobs were lost (La Jornada, 1996).

At first glance, the austerity plan appeared to be working. In the first quarter of 1995, Mexico's negative trade balance reversed, and the country ran a slight surplus. Of the \$29 billion kept in *tesobonos* during 1995, \$16 billion had been retired. The peso was stabilized at about six per dollar. While interest rates remained high, they were falling and values on the stock market rose more than 30 percent from their March lows. For the average Mexican, however, the economy remained in crisis. In the first four months of 1995, prices rose nearly 24 percent. The interest rate on short-term government borrowing remained over 60 percent (Banco de Mexico, 1996).

Economic Analysis

The Behavior of Relevant Economic Indicators

Behavior of the principal macroeconomic indicators before and during the period of President Zedillo suggests general improvement of the nation's economy (Table 2.2). General analysis of some of these indicators does mask impact of major macroeconomic policies on micro level households and enterprises.

Table 2.2. Mexico. Macroeconomic indicators. 1990-2000

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
GDP growth (percent) (a)	5.2	4.2	3.5	1.9	4.5	-6.2	5.1	6.8	4.8	3.7	7.1
Internal savings (percent of GDP)	20.3	18.7	16.6	15.2	14.7	19.3	22.7	24.0	20.6	20.3	20.1.
External savings (percent of GDP)	2.8	4.7	6.7	5.8	7.1	0.5	0.7	1.9	3.8	2.9	N.A.
Total exports (percent of GDP)	N.A.	N.A.	N.A.	15.2	17.2	23.9	26.8	27.8	29.8	32.7	33.4
Annual inflation (percent) (b)	29.93	18.79	11.93	8.01	7.06	51.97	27.70	15.72	18.61	12.32	8.96
Open unemployment rate (percent)	2.7	2.7	2.8	3.4	3.6	6.3	5.5	3.7	3.2	2.5	2.1
International reserves (c)	9.86	17.73	18.94	25.11	6.28	16.85	19.43	28.80	30.10	30.70	33.55
Exchange rate (pesos per dollar)	2.94	3.07	3.12	3.11	5.33	7.64	7.85	8.08	9.87	9.51	9.65
Fiscal deficit (percent of GDP)	-2.6	-0.5	1.4	0.7	-0.1	0.0	0.0	-0.7	-1.2	-1.2	-1.0

Notes

- a) Annual average variation at 1993 prices.
- b) Inflation with respect to December previous year.
- c) Total reserves in billion dollars.

Sources

- Secretaria de Hacienda y Credito Publico (SHCP).
- Banco de México.
- Instituto Nacional de Estadística, Geografía e Informática. (INEGI).
- Banco Interamericano de Desarrollo (BID), 2002.

Gross Domestic Product (GDP)

After the severe contraction that the GDP registered during 1995 as a consequence of the financial and economic crisis of the previous year, the economy in Mexico displayed positive growth rates. Zedillo did inherit an increasing GDP of 4.5 percent in 1994 and saw it moving down during the following year at a decreasing rate of -6.2 percent. The recovery was notable during 1996 with a 5.1 percent increase and the subsequent 6.8 percent in 1997. The economic measures implemented by the Zedillo administration allowed a swift recovery and so, during the period of 1995 to 2000 the economy in Mexico grew at an annual average rate of 4.2 percent making it the highest rate for a similar period during the previous 30 years.

GDP Per Capita

Despite having experienced a resounding drop in 1995, GDP per capita -measured in dollars- reached levels that were even higher than 1994. In 1999 this economic indicator attained a 13 percent increase, which is registered as an historic maximum. GDP per capita from 1991 to 1999 while somewhat variable shows a slight improving trend over the period when calculated with the prevailing average exchange rate corresponding to that year. Clearly 1995, as a post devaluation year, shows serious change (Table 2.3).

The positive effect of economic policy in the mid 1990's, in terms of recuperating to the previous levels is clearly evident (Figure 2.2). And for the year of 2000, GDP and GDP per capita started to show an increasing tendency, again reaching one of the highest levels during the last ten years. The percentage annual variation of GDP as well as the behavior of GDP per capita following the 1994 crisis is illustrative policy effects.

Table 2.3. Mexico. GDP per capita, 1991-1999

Year	Current pesos	Dollars
1991	11,379	3,778
1992	13,142	4,247
1993	14,368	4,612
1994	15,907	4,713
1995	20,152	3,139
1996	27,104	3,576
1997	33,559	4,238
1998	39,942	4,372
1999	47,214	4,938

Source: Secretaría de Hacienda y Crédito Público (SHCP)

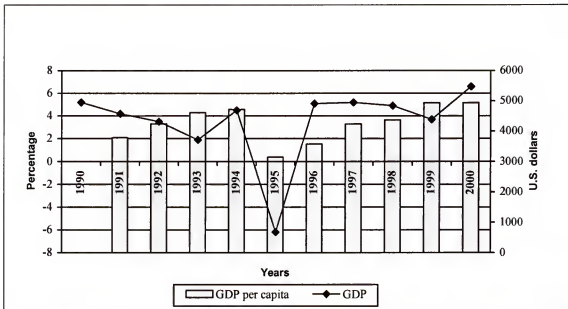


Figure 2.2. Mexico. Percentage annual GDP variation and GDP per capita, 1990-2000

Savings

When the economic growth is mainly financed with external (foreign) savings - without having an increase in the level of domestic savings-, the possibility of an economic crisis is high (Chacholiades, 1978). In Mexico such a crisis happened because of the excessive dependence on external capital placing the country in a vulnerable position with respect to the events of the world economy. The economic policy initiated in 1995 fomented domestic savings, which contributed to reducing this dependency, and also helped to maintain the deficit in the current account under sustainable levels. While

in 1994 domestic savings were 14.7 percent of GDP, by the end of 2000 the level was greater than 20 percent. Simultaneously foreign investment reduced its participation in financing investment, from 7 percent of GDP in 1994 to only 2.9 percent in 1999.

Prices

Devaluation in 1994 caused a considerable increase in inflation for the following year, attaining a level of almost 52 percent. The application of restrictive policies - monetary and fiscal- permitted a dampening tendency for the year of 1996 (Gonzalez Gomez, 1998). By the end of 1999, the observed inflation rate was 12.32 percent, which was slightly below the 13 percent programmed in General Criteria for Economic Policy for that year (Secretaría de Hacienda y Crédito Público, 1999). For the year of 2000, inflation reached single digits at 9 percent. Behavior of the inflation rate from 1981 to 2002 as well as variation with respect to the previous year shows a downward trend and greater stability respectively (Figure 2.3). Both measures suggest advantages in maintaining restrictive monetary and fiscal policies.

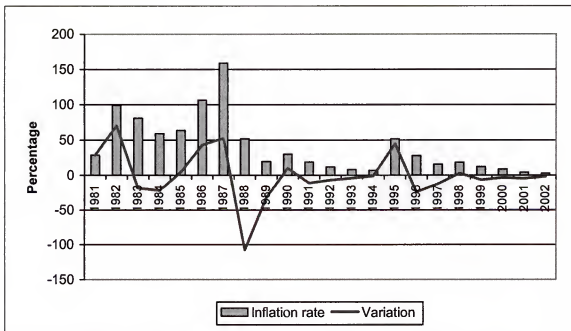


Figure 2.3. Mexico. Inflation rate and percentage variation, 1981-2002

Employment and Wages

According to an indicator of the number of workers registered in the Mexican Social Security Institute (IMSS), during Zedillo's presidency more than 3 million jobs were created (Instituto Nacional de Estadística, Geografía e Informática, 2001). This fact has been reflected in a sustained reduction of the open unemployment rate, which in 2000 reached a level of 2.3 percent, the lowest since 1985, the first year this indicator was registered. In 1999, economic growth translated to higher levels of employment. For 1999, the IMSS registered an average of 10.6 million permanent workers, reaching an historic level since the institute's creation in 1943 (Figure 2.4). It is important to mention, however, that the government established target was not achieved. In The government forecasted an average of one million jobs per year but left the reform to the Federal Law of Work incomplete. The administration also failed in its attempt to increase the purchasing power of workers (Berumen, 2000).

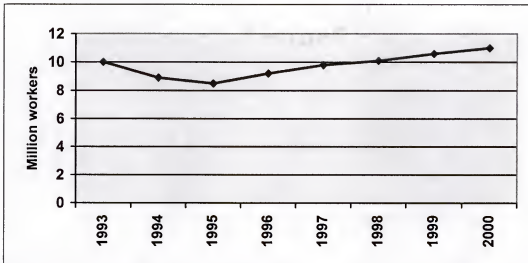


Figure 2.4. Mexico. Permanent worker registration in the Mexican Social Security Institute, 1993-2000

With respect to wages, by the end of the Zedillo's period, workers saw their real wages moving on a positive trend for most economic sectors. This was a consequence of

favorable conditions in the labor market, a decline in inflation and an increase in the productivity level of workers. In the period of 1995-2000 nominal raises in federal bureaucratic wage rates registered an average annual increase of 17.4 percent against a 25.3 percent average annual inflation rate (Zedillo Ponce de Leon, 2000). Real wages in the manufacturing sector started recuperating in 1997. During the period of 1997-1999 the average rate of real growth was of 1.1 percent.

External Sector

Deficit in the trade balance is a result of import value exceeding export value. During the period of 1995-1999 an average surplus of 149.17 million dollars was maintained. This figure contrasts with the observed average during the period of 1988-1994 of -7,574.97 million dollars. The reasons behind the change in the trade balance are explained by the strategy implemented by the government in terms of globalization and trade liberalization. There was also a governmental policy of supporting international trade given the slow recuperation of the domestic markets after the crisis. Devaluation generated a significant increase in Mexican exports, mainly to the U.S. market (Figure 2.4).

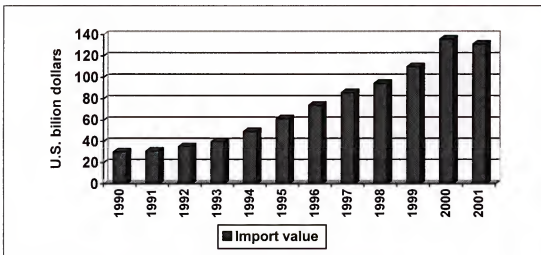


Figure 2.4. U.S. General import value from Mexico, 1990-2001

The export sector experienced strong growth during 1995-2000. Mexico became in 2000 the seventh largest exporter in the world and the first in Latin America. By the end of 1999, exports represented a 32.7 percent of the GDP, whereas in 1994 this figure was on the order of 17.2 percent.

In May of 2002, the deficit in trade balance was about -522 million dollars. This negative balance is smaller than the one observed in the same month of 2001. During the first five months of 2002, accumulated deficit was -2,800 million dollars, while in the same period in 2001 it was -3,649 million dollars (Figure 2.5). The value of exports accounted for 13,921 million dollars, of which almost 91 percent were from non-oil products and only 9 percent from oil. This figure, however, represented a reduction of one percent with respect to the same period in 2001, derived from a drop of 1.9 percent of non-oil exports and an 8.7 percent increase in oil exports.



Figure 2.5. Mexico. Trade balance 1997-2002.

Imports in May 2002 were 14.5 million dollars, which is -1.5 percent less with respect to the same month in 2001. This figure is a combination of a decline of 3.4

percent in intermediate goods and respective increases of 2.5 and 6.3 percent in capital and consumption goods (Table 2.4 presents a summary of the external sector situation in Mexico from 1997 to 2002).

Table 2.4. Mexico. External sector. 1997-2002.

Year	1997	1998	1999	2000	2001	2002
Current Account (a)	-6,665	-15,786	-14,000	-18,160	-18,002	-15,663
Current Account (percent of GDP)	-1.9	-3.7	-2.9	-3.1	-2.9	-2.4
Capital Account (a)	16,639	18,419	13,480	17,194	24,522	23,039
Trade Balance (US\$ m)	623	-7,914	-5,584	-8,003	-9,729	-8,642
Exports (a)	110,431	117,459	136,391	166,455	158,547	158,710
Imports (a)	109,808	125,373	141,975	174,458	168,276	167,352
Exports. Annual Variation (percent)	15.0	6.4	16.1	22.0	-4.8	-2.1
Imports. Annual Variation (percent)	22.7	14.2	13.2	22.9	-3.5	-2.6
External Debt (a)	139,940	151,878	161,912	148,652	144,548	144,634
External Debt (percent of GDP)	34.9	36.1	33.7	25.6	23.4	21.7

Note: a) Expressed in U.S. million dollars.

Some International Trade Remarks

During the presidential periods of Zedillo and Salinas, the external sector in Mexico has shown a dynamic behavior. Some of the most significant facts occurred during this time are listed below.

- Since 1993 Mexico's total trade has expanded 191 percent, going from 117.2 billion dollars to 340.1 billion dollars in 2000, growing at an annual rate of 18 percent.
- Mexico has displaced Japan as the U.S.' second largest trading partner accounting for 12 percent share of total U.S. trade and only surpassed by Canada with 20 percent share. U.S.-Mexico trade has grown on average 17 percent per year (Figure 2.6).
- With the implementation of NAFTA Mexico became Canada's fourth supplier. Mexico is also Canada's main trading partner in Latin America, and Canada is the second largest market for Mexican goods. Canada-Mexico trade has grown on average 15 percent per year.

- The automobile industry has been one of the most dynamic economic activities for the last eight years. Between 1995 and 2000 automobile exports represented 62,742 million dollars, which meant an average growth of 9.1 percent.
- To date, Mexico has signed trade agreements with Europe, North America, Israel and six more nations in South America and Central America. It has also been incorporated into the North Triangle that includes 9 countries. No other country in world exceeds Mexico in number of trade agreements.
- Access and exports to the European Union, the largest market in the world has had a significant increase: from 75 percent during the period of 1988-1994 to 86.6 percent during 1994-2000.
- Export participation (other than oil) moved from 85 percent of total exports during 1988-1994 to 91 percent by the end of 2000. This movement represents protection for external accounts against international oil price fluctuations.

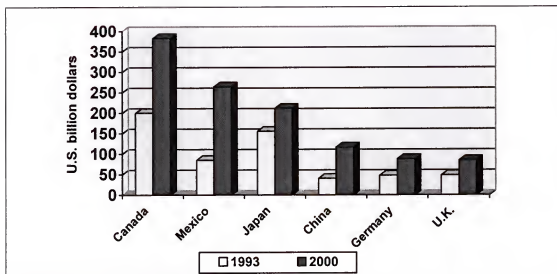


Figure 2.6. U.S. total trade and main trading partners

Current Account

During Salinas' period, the average deficit in the current account was 4.4 percent of the GDP, reaching a maximum of 7 percent in 1994. From 1995 to 2000 this deficit averaged 1.97 percent. Note the tendency of this deficit toward increases following readjustment policies. Concretely, during 1999 the current account deficit was 14,153 million dollars, which represented a 2.9 percent of the GDP. This deficit is smaller by 12 percent than the one registered in 1998 and 52.3 percent lower than that of 1994, but the

tendency during the period of 1995-2000 is similar to the one observed during the period of 1988-1994, except for the absolute amount of the deficit (Figure 2.7).

The deficit within the current account from 1995 to 1999 was mainly financed – according to the Secretaría de Hacienda y Crédito Público (Ministry of the Treasury) – with direct foreign investment and partially with the external debt of public and private sectors (Secretaría de Hacienda y Crédito Público, 2000). During this period incoming investment was on the order of 60,000 million dollars. During Salinas' presidency, the proportion of the deficit in the current account covered with portfolio investment averaged 57.9 percent, i.e. more than half of this deficit was financed with short run investment, which implies more risk than its counterpart.

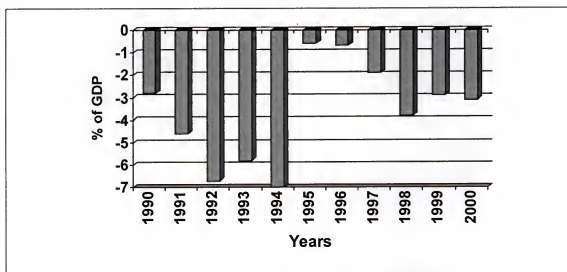


Figure 2.7. Mexico. Current Account as percentage of GDP 1990-2000

Exchange Rate

Lowering the dollar parity of the peso, or devaluation, is an economic instrument Mexicans are more familiar with. Its occurrence has been present in the economic life of the country for the last 20 years. Considered one of the most effective mechanisms to control persistent deficits in the balance of payments, devaluation has become a common

practice among the countries with difficulties in their external sectors. Countries such as Spain, Portugal, Italy and many others frequently resort to this instrument in spite of its inconveniences. The most important of them being the inflation generated afterward, which offsets the comparative advantage generated by devaluation. In Mexico, devaluation is considered so unpopular that the government only opts for it as the last available policy option. For a vast majority of Mexicans, devaluation represents the main symptom of a crisis. The effect of the exchange rate variation for the last two decades, demonstrated in Figure 2.8, is very significant. It can be seen that inflation was strongly related to devaluations during the 1980's and inevitably in 1995. After that year, however, inflation has been maintained "unaffected" by variations in the exchange rate.

Equally challenging, the large dependency that Mexico has with the U.S. economy in terms of intermediate goods, makes the positive effect of devaluation disappear in a short period of time. During the 1980's the Mexican economy depended more than 90 percent on imports from the U.S. (Galindo y Guerrero, 1997). After NAFTA was implemented, trade became more balanced, and the exchange rate more successfully maintained. In 1998 Mexico experienced a minor adjustment in its exchange rate that favored the export of multiple products, including agricultural commodities. During the latest five years, the dollar remained constantly around the value of ten pesos, a pattern only observed at the beginning of the 1990's.

International Reserves

The favorable situation in the external accounts for the first trimester of 2000 provided an increase in international reserves reaching a total of 34 billion dollars (Banco de Mexico, 2001)

Financial Sector

The abatement of inflation, public finance management and more confidence in the economic strategy applied, contributed to generate more stability in financial markets.

Thanks to the flexibility of the economic strategy in terms of adapting to adverse situations, interest rates fell and stabilized around 15 percent.

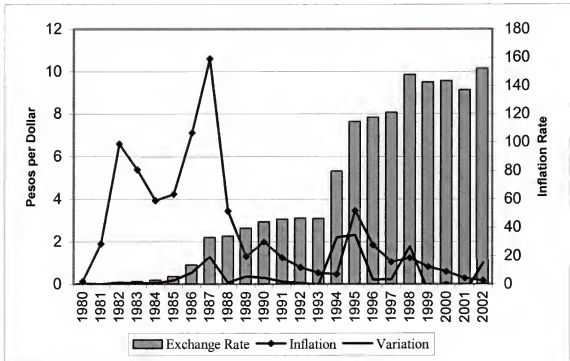


Figure 2.8. Mexico. Exchange and inflation rate 1980-2002

Zedillo experienced at least three evolutionary stages related to exchange rates and interest rates:

- A severe stage derived from a mismanaged devaluation, which was more prolonged than necessary, mainly due to the lack of a program to support the foreign exchange policy. This period is characterized by an extremely volatile exchange rate, highly influenced by speculative capital.
- A stabilization period where the currency was supported by indirect credits (*creditos puente*). During this stage the government applied austerity policies to reduce volatility. This flexible policy allowed confrontation of external changes, and the economy, as a whole, was not severely affected.

- A period of international adjustment that created some variability on all currencies but with minor impact in Mexico. The consequence was an increasing flow of capital into the country. A similar situation was previously presented in 1993 but the peso was weaker at that time (Arteaga, 2000).

It is possible to conclude that adoption of a flexible exchange rate provided the following benefits:

- It avoided the generation of external disequilibria as experienced in 1994.
- Represented a disincentive for the entry of long-run speculative capital; and,
- Permitted a more organized adjustment of the economy against the impact of external variations through its balance between the interest rate and the exchange rate.

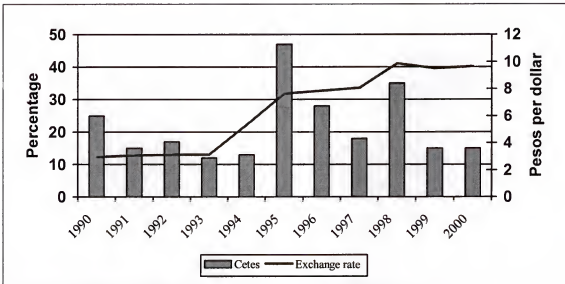


Figure 2.9. Mexico. CETES and the exchange rate 1990-2000

The relationship between the interest rate offered by the CETES (at 28 days) and the exchange rate shows a somewhat diverging pattern in recent years due to the devaluations (Figure 2.9). Once the interest rate increases, devaluation against the dollar follows. The interest rate, however, reverses its tendency but the exchange rate does not follow this pattern. Another highly volatile factor, not only in Mexico but also in the entire world, is stock market behavior. After Mexico opened its doors to the world market, not only in goods but also in assets, the Mexican Stock Exchange (Bolsa

Mexicana de Valores –BMV) responded, not only to domestic economic conditions, but also to foreign conditions. The crises in 1994 and 1997, and the impact of the Nasdaq scandal in 2000 can be clearly seen as having an effect on the performance of the BMV (Figure 2.10).

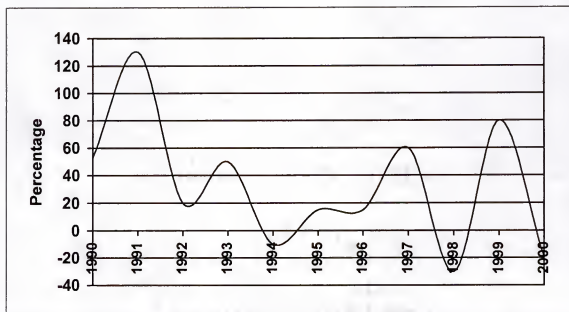


Figure 2.10. Mexico. Overall performance of the Mexican Stock Exchange 1990-2000

Finance and Public Debt

Economic Balance of the Public Sector

At the beginning of his term, Zedillo was determined to maintain public finance in good condition. As a result of this effort, public finance showed a positive evolution during his term. This was so, in spite of the contraction suffered by public income from 23.1 percent of the GDP in 1994 to 20.7 percent in 1999, resulting from the decoupling of enterprises from the public sector. This income reduction was compensated by larger participation of oil exports, which represented 32.5 percent of the GDP in 1999 against 27.9 percent at the beginning of Zedillo's presidency. Governmental income benefited due to the rise in the value-added tax (IVA) from 10 to 15 percent (a 50 percent

increment), while the revenue corresponding to the Rent Tax (ISR) slightly descended to 4.5 percent of the GDP in 1999 from 5 percent in 1994.

Public sector expenditures represented 22.5 percent of the GDP in 1999, against 22.9 percent in 1994. Some programmed expenditures diminished by more than 2 percent. These disciplined manner of exercising expenditures allowed the government to maintain a financial balance with a deficit not larger than 1.5 percent of the GDP, a historic record as well (Arteaga, 2000).

One important weakness of incomes corresponding to the public sector was its dependency on oil revenues. These revenues, which are highly related to the behavior of international oil prices and their sudden volatility, make the public budget susceptible to unpredictable variations. This situation was more evident in 1998: oil prices dropped from 16.5 dollars per barrel in 1997 to 10.2 dollars per barrel in 1998 and the programmed expenditures had to be reduced to comply with the targeted public deficit. Zedillo, seeking to obtain more stable and permanent ways to finance public expenditures, held to the increase in the IVA in spite of the crisis. In 1999, however, federal income was about 14.6 percent of the GDP, 0.9 percent less than in 1994. The factors explaining this difference are the reduction in tariff collection as established by the trade agreements and variations in the international oil price (Zedillo Ponce de Leon, 1999) (Table 2.5).

Table 2.5. International oil price 1997-2000

Year	Average price (Dollars per barrel)
1997	13.43
1998	7.67
1999	22.14
2000	18.80

Source: Secretaria de Economía

Government Expenditures Policy

During the Zedillo administration, public expenditure policy was a crucial instrument for compliance with the objectives of growth with stability, and was sustained by reestablishing social development expenditures and strategic investments for national development (Ortiz Wadgyr et al., 2000). The main actions taken in regard to public expenditure during Zedillo's term include:

- Strengthening of social expenditure and elimination of extreme poverty,
- Improving public security and the justice system,
- Fostering investment and economic growth.
- Promoting rural development, and
- More efficient application of public resources.

Public Debt

During his last presidential report, Zedillo informed the nation that public debt had been considerably reduced as a proportion of the GDP; the country, however, was still in debt with several international organisms that supported Mexico in 1995 (Infosel financiero, 2000). In addition, during the period of 1999-2001, Mexico received loans for the amount of \$26 billion dollars, granted to ensure the governmental transition without crisis.

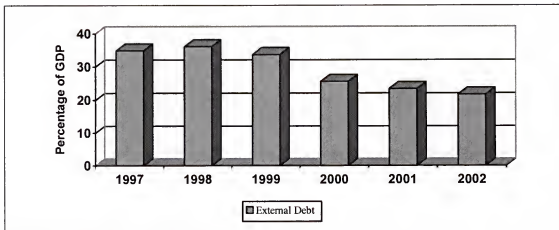


Figure 2.11. Mexico. External debt 1997-2002

Resulting from the financial protection implemented by the government of Zedillo, external public debt was reduced as a percentage of the GDP from a 32.4 percent in 1994 to a 16.1 percent in 1999 (Figure 2.11). The financial program of 1999-2000, better known as the “economic armor”, included resources by the amount of \$17 million dollars destined to finance international trade. It also included an additional \$7 million dollars to act as an emergency line. Its main objective was to refinance external debt to prolong the payment expirations of 2003 and 2005 (Berumen, 2000). The international organisms that supported Mexico are the International Monetary Fund, World Bank, Banco Interamericano de Desarrollo (BID) and the Eximbank. In return for these funds, Mexico was compromised to:

- Reaching a real economic growth greater than 3 percent within the period 1999-2000.
- Reducing fiscal deficit from -1.5 percent to -1.0 percent of GDP.
- Continuation of the policy of inflation abatement, through strict monetary policy.
- Continuing with the process of consolidating the banking system and the structural reforms of the financial system.

Income Distribution

Zedillo left the country with remarkable and expanded differences in income distribution illustrated by a high concentration of income in a minority of the population and a major part of the Mexican people in poverty. According to the Economic Commission for Latin America and the Caribbean (ECLAC), the poverty level in Mexico increased from 40.5 to 45.5 million, of which 26 million, mainly farmers and indigenous people, live in extreme poverty (CEPAL, 2000). Poverty moved from 36- 38 percent of total Mexican households in 1994 to 45-47 percent in 1998. Furthermore, between 1994 and 1998 those households living under the poverty line, with a monthly income less than

560 pesos (at constant value of April 1994), increased from 69 percent to 76 percent (Instituto Nacional de Estadística, Geografía e Informática, 2000). Poverty increased by more than 5 percent during Zedillo's presidency. Recent estimates are that 20 percent of the Mexican population (more than 20 million) lives under conditions of extreme poverty and more than 40 million live below the poverty line. Between 1994 and 2000 real wages suffered an accumulative deterioration of 72 percent. This deterioration represents the lowest purchasing power registered during the last 20 years in Mexico. According to the United Nations (UN), 64.5 percent of the population in Mexico receives a salary equivalent to twice the minimum wage and this salary is insufficient to obtain the minimum nutritional standards (United Nations, 2001). In 2000, women sustained about 40 percent of households in Mexico with incomes up to 20 percent lower than those received by men, and more than half of the Mexican population at legal working age was employed by the informal sector of the economy (Instituto Nacional de Estadística, Geografía e Informática, 2000).

According to the Income-Expenditure National Survey made by the National Institute of Statistics, Geography and Informatics in 2000, 38.11 percent of national income is concentrated in the highest 10 percent of the income distribution. At the other extreme, the lowest tenth percent receives only 1.5 percent of national income. In 1996 this proportion was almost 1.8 percent. From every peso generated by the economy in Mexico during 1996, 0.07 cents were redistributed to the poor sector. The high-income sector, however, held slightly more than 50 cents.

Education

One of the issues with more relevancy during this period was education. Zedillo was determined to remove illiteracy from the Mexican society so that development could

be attained. Education targets for the year 2000 were mainly two: a) a 7.5 minimum years of schooling among that part of the population of 15 years of age or older; and b) a 50 percent reduction in the number of children between 6 and 14 years of age not attending school (Zedillo Ponce de León, 1995c). The results were not those projected by his administration (Table 2.6). Zedillo left an equal number of illiterates as those existing at the beginning of his presidency: 6 million adults with less than the minimum years of schooling established, and an illiteracy index of 9.7 percent. Current average years of schooling in Mexico are 6.6 years. There are 1.57 million children between 6 and 14 years who do not attend school, which is almost 500 thousand fewer than in 1995. This represents a drop in school attendance of 21 percent (Infosel financiero, 2000).

Table 2.6. Mexico. Illiteracy (population of 15 or more years of age) 1970-1995

Year	Percentage
1970	24.8
1975	21.3
1980	17.0
1985	15.0
1990	12.4
1995	10.5

Source: Banco Interamericano de Desarrollo (BID).

The Agricultural Scenario

The trade liberalization promoted by NAFTA has been accompanied by large volumes of trade in a wide variety of food and agricultural products between the United States, Canada and Mexico. During the nine years of NAFTA, agricultural trade within the North American region has increased at higher rates than the rest of the world. Between 1994 and 1998, agricultural exports from the U.S. to its NAFTA counterparts increased at an annual rate of 8.1 percent, in contrast with a 2.6 percent to the rest of the world. U.S. imports from Canada and Mexico grew 11.1 percent per year against a 6.7

percent from the rest of the world. The increase in exports from the U.S. to Mexico has compensated for the drop in exports to other countries. Between 1997 and 2000 U.S. exports to countries out of NAFTA decreased by 18 percent while exports to Canada and Mexico increased by 4 and 12 percent respectively (Secretaría de Economía, 2002).

In 1993, before the agreement was implemented, Mexico absorbed 8.4 percent of total U.S. agricultural exports. In 1998 Mexico's share was 12 percent. On the other hand, U.S. agricultural imports from Mexico represented 10.8 percent before NAFTA and recently this participation has increased by fifty percent to nearly 16 percent. During recent years, Mexican agricultural imports from the United States moved from 3.8 billion dollars in 1993, to 6.5 billion dollars in 2000 (Zahniser, 2000) (Figure 2.12). Seven products –soy, cotton, corn, meat, sorghum, poultry meat and wheat- accounted for 51 percent of this total. Exports from Mexico to the U.S. increased at an average rate of 12 percent and in 2000 reached a record of 5.2 billion dollars. Fruits, horticultural products, coffee, sugar and cattle accounted for more than 50 percent of the total.

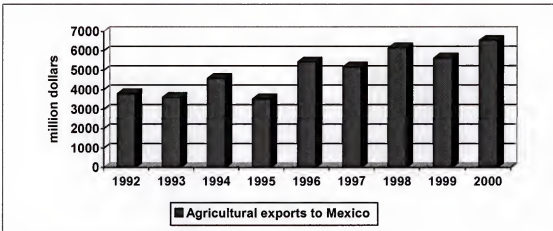


Figure 2.12. U.S. agricultural trade with Mexico, 1993-2000

Mexico's agricultural trade balance, however, has been under a deficit in recent years, with the exception of 1995. In 1995 devaluation of the peso and recession acted as

an excellent tariff and a trade balance surplus resulted from a 23 percent reduction in imports. Export revenues also increased as a result of the price increase experienced by agricultural products. The 1995 crisis in Mexico and its corresponding aftermath eliminated the effects created by tariff reduction under NAFTA. The purchasing power of workers was reduced at the time that price competitiveness increased. As a consequence, agricultural imports were reduced from 4.6 billion dollars in 1994 to 3.5 billion dollars in 1995. According to the United States Department of Agriculture (USDA) agricultural imports from the U.S. dropped by 22 percent, eliminating the 1994 increase. Meanwhile, Mexican exports dramatically increased. As the Mexican economy established a strong recovery process in 1996, trade returned to previous levels. Agricultural imports resurfaced reaching 4.6 billion dollars and imports originating in the U.S. increased by 55 percent or more than compensating for the lost in 1995. Mexican exports to the U.S. decreased slightly and the trade balance again became deficit.

Those commodities experiencing the major trade changes during NAFTA are those having the highest tariff rates and those with non-trade barriers before the agreement. Approximately 80 percent of Mexico's total agricultural imports are grains, oilseeds and byproducts. Mexico is considered a net importer of food since its grain and oilseeds exports are not significant. Grains and oilseeds trade among NAFTA countries is a two-way trading situation between the U.S. and Canada but it is one-way between Mexico and the U.S. Mexico imports significant levels of grains and oilseed from the U.S. In 1990 Mexican imports of grains from the U.S. totaled 1.3 billion dollars out of 1.526 billion dollars of total grain imports. Grains and oilseeds also represented more than 50 percent of the total agricultural imports originating in the U.S. For 1999 grains and oilseeds

imports from Mexico accounted for 3.9 billion dollars. The commodity with a major trade impact during in recent years has been corn. This agricultural product represents the most important agricultural product in terms of volume, cultivated area, value of production and number of producers in Mexico. During recent years, Mexico has imported corn from the U.S. to supplement the Mexican diet at the level of 2 million tons per year (Apoyos y Servicios a la Comercialización Agropecuaria, 2000). This situation has compromised rural and agricultural life in Mexico because corn constitutes an important symbol of Mexican culture and serves as the spine of the agricultural sector.

Orange Juice Exports

In 1994 Mexican orange juice exports increased due in part to a production decrease in Florida of 6 percent. Also Brazil was affected by a drought that provoked a decrease between 6 and 10 percent in production. It is estimated that Mexico exported 45.46 million gallons of single strength orange juice to the U.S. during that year, 8 percent above the tariff rate quota in NAFTA. In 1995, Mexican participation in the U.S. orange juice market was even larger than in 1994 due to the positive effect created by the December devaluation (Spren et al., 1996). The loss in purchasing power in Mexico reduced fresh fruit consumption making processing for export more attractive. Once again Brazil suffered drought that reduced its supply to the international market. At that time expectations were that without the effect of devaluation, Mexican exports would have reached 47.47 million gallons instead of the more than 65 million gallons attributed to the devaluation (Spren et al., 1996).

During 1996 and 1997 Mexico was still benefiting from the previous scenario. Production in Mexico increased and the impact of tariff reduction offered by NAFTA was positive. During 1998 Mexico reached an historic level of FCOJ exports to the U.S.

mainly due to lack of supply internationally and a 33 percent reduction in Brazil's participation. Although another minor devaluation was in 1998 presented in Mexico, its effects have not been analyzed as carefully as the one in 1994.

In 1999 the level of exports decreased dramatically due to a reduction in Mexican production and the prevalence of low prices. Also the peso was revaluated which affected the profitability of orange production in Mexico. In 2000 Mexico was barely able to fulfill the 40 million gallon quota. Two factors created this situation: low prices and a significant reduction in production provoked by a drought occurred in 1998, and the loss of 18 thousand hectares of oranges in Veracruz by the flood of 1999.

Final Comments

Zedillo's government has had both successes and failures in the economic arena. During his administration, the handling of macroeconomic variables was remarkable. Public finance, the inflation rate and economic growth demonstrate Zedillo's determination to maintain the country under optimal conditions, notwithstanding the oil price drop in 1998. For the first time in two decades it was possible to maintain an average annual growth greater than 5 percent for five consecutive years. This evolution was facilitated by favorable behavior of external conditions, stimulated by the most prolonged expansion period in the U.S. economic history and by the recovery of international oil prices during those years. With respect to employment, by the end of this period the unemployment rate was at one of the lowest levels of the decade.

The more relevant political limitations of Zedillo are related to his inability to negotiate reforms needed for the future of Mexico. Constitutional changes focused on allowing private investment in the oil and electricity industries were not implemented.

Public expenditure was maintained with a structure that relies on revenues generated by exports of oil, resulting in perception of unnecessarily volatility.

The external vulnerability that currently exists in Mexico can be seen as a consequence of: 1) a sudden and unilateral opening of the economy, 2) the abatement, at all costs, of inflation with a policy of a free exchange rate, and 3) the abandonment of productive promotion policies that deepened internal economic disequilibria. Zedillo suspended a significant part of subsidies and credit facilitations to agriculture, which is considered the cause of losses in competitiveness now prevailing in Mexico.

A New Era in Mexico

In July 2000, Mexico underwent a significant political change—it elected Vicente Fox, candidate of an opposition alliance, to a six-year presidential term. With this new election, Mexico ended an era of seventy-one years of hegemonic rule by the Institutional Revolutionary Party (PRI) and created a spectrum of possibilities for the nation's future. What are those possibilities and what are the main challenges for the new government?

Mexico's economic challenge is both qualitative and quantitative. It must continue to grow, but it must reconfigure its patterns of income distribution, which are among the most unequal in the Third World. Obviously, the economic relationship with the United States remains fundamental and in many ways Mexico's greatest asset—not only in terms of investments and markets, but also remittances of uncounted billion of dollars by Mexican nationals working in the U.S. On the other hand, Mexico's heavy focus on U.S. markets makes it unusually vulnerable to changes in the U.S. economy; a deceleration in the U.S. economy would have serious consequences for Fox's program. Mexico also faces an increase in its debt payments, which was rescheduled in 2000 during Zedillo's presidency.

Fox is taking measures to increase income from tourism, already Mexico's second largest foreign exchange source (about \$8 billion yearly). Although not officially announced by Fox, the Mexican media spreads rumors of his intention to privatize petrochemical plants and electrical generators. He also favors a major reform to break up Mexico's complicated labor market. He proposes to allow more freedom for investment of pension funds. Fox agenda also includes is also seeking to significantly increase tax collections.

CHAPTER 3 THE CITRUS INDUSTRY IN MEXICO

The development of the citrus industry in Mexico has been in constant transformation. The orange juice processing industry has reacted to fluctuations in the demand and supply of orange juice that occurred in the U.S. market. The recurrence of natural phenomena in Florida provided sufficient economic incentives to proliferate a processing industry that started in 1972 with the first plant established in the northern part of Mexico.¹ The economic bonanza generated by the lack of supply in the U.S. market, rapidly transformed the industry in Mexico as indicated by an increase in the processing capacity of more than a two hundred percent by 1980 (Mondragón et al., 1998). The 17 processing plants operating at that time were strategically located along the orange production zones in the southeastern part of Mexico.

Establishment of new orange plantations occurred as a response to the imminent increase in the demand for oranges at the new processing plants. Farmers immediately tried to respond to the needs of the processing sector with a major increase in the total land area of orange groves rather than concentrating (or combining their objective) on increasing yields. Production, planted area and harvested area in Mexico during the period 1980-1999 suggest an unrelated behavior of these characteristics with the yields obtained during the same period (Table 3.1).

¹ Some sources report that the first processing plant was established in 1949 in Coatepec, Veracruz.

A strong upward trend was maintained by the area planted with oranges during the first ten years of the period extending from 1987 to 1999. While the area planted maintained this pattern, yields were highly variable during these years (Figure 3.1). This land extension also entailed a relocation of the citrus producing zones that were affected by the same freezes resulting in the imbalance in the U.S. market. States such as San Luis Potosi and Veracruz soon became the leaders in the production of oranges in the country.

Table 3.1. Mexico. Orange production, yields, planted and harvested area. 1980-1999

Year	Production (Tons)	Harvested area (Hectares)	Yields (Tons/Hectares)	Planted area (Hectares)
1980	1,743,212	161,937	10.760	168,208
1981	1,822,087	166,914	10.920	181,651
1982	2,083,061	169,879	12.260	201,991
1983	2,098,619	186,593	11.250	204,883
1984	1,656,927	150,459	11.010	198,381
1985	1,770,208	127,646	13.870	181,222
1986	1,952,395	135,565	14.400	195,094
1987	1,966,057	175,585	11.200	209,488
1988	2,076,359	159,755	13.000	225,746
1989	2,372,228	173,822	13.650	235,836
1990	2220,338	176,003	12.615	239,929
1991	2,369,492	182,756	12.965	265,840
1992	2,541,487	217,583	11.681	272,325
1993	2,913,686	240,683	12.106	286,448
1994	3,191,147	257,334	12.401	302,416
1995	3,571,541	273,186	13.074	327,601
1996	3,984,608	312,602	12.750	343,217
1997	3,943,858	307,332	12.830	322,277
1998	3,331,152	305,755	10.890	330,182
1999	3,520,032	312,836	11.250	323,936

Source: Secretaria de Agricultura, Ganaderia y Desarrollo Rural

Despite the large expansion in orange production, the processing industry continued to confront a lack of supply and, in addition, an overproduction of oranges appeared a decade later (Schwentenius Rinderman and Gomez Cruz, 1999). Not until then was the real problem revealed: there existed poor and insufficient coordination between growers and processors that resulted in underutilization of installed capacity. Even in

1990 when Mexico reached one of the highest levels of orange juice exports to the United States, the total utilization of installed capacity was about 40 percent (Schwentenius Rindermann, and Gomez Cruz, 1999). This same year, however, a total of 28 processing plants were operating in Mexico motivated by the freezes that once again affected Florida groves in 1989. Expectations were good for the Mexican orange juice industry and the national bank system supported this opportunity. A few years later a reverse situation resulted in many plants going out of business. To date in 2003, the industry has been reduced to 12 operating orange juice plants; eight plants are still open but not producing orange juice, and eight more plants have disappeared from the market.

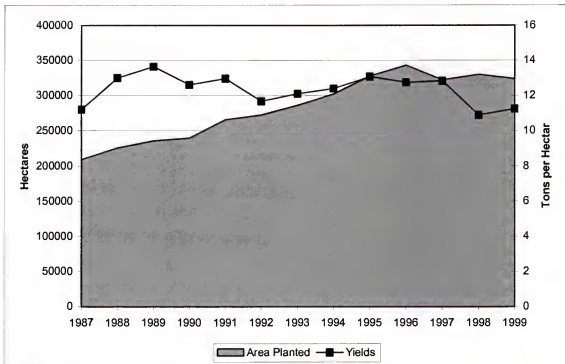


Figure 3.1. Mexico. Citrus-planted area and yields 1987-1999

Among the factors that were not considered during the transformation of the citrus industry in Mexico, besides weak coordination between orange producers and processors, was the emerging competition from Brazil as an aggressive producer. At the same time,

the recuperation of the industry in Florida involved a move south to prevent further damage from freezes.

Orange juice production in Brazil started a vigorous increase during the 1980's, surpassing Florida as the world's largest orange juice producing region. During the 1997-98 season, orange production in Brazil reached almost 19 million metric tons, representing more than 30 percent of total world production (Spreen, 1998).

Florida, having experienced a steep decline in bearing tree numbers between 1980 and 1986 resulting from the freezes-, recovered to pre-freeze levels by 1992. The swift recovery of the industry in Florida resulted in a record number of orange trees for the 1997-98 season leading to a record high level of production at 9.96 million metric tons.

Although no objective data are available, Mexican farmers apparently believed that a recovery of the citrus industry in Florida was improbable.² The recovery of orange production in Florida was also characterized by the adoption of new technology utilized in the new plantings. The innovations included higher yielding rootstocks, improved irrigation systems and denser plantings (Spreen et al., 1992). In Mexico expansion of orange groves mostly took place on communal lands called ejidos, characterized by low yields, mainly due to the lack of know-how in production of citrus and the absence of technology by ejido farmers (ejidatarios).

The evolution of the citrus industry in Florida and the emergence of the industry in Brazil were also characterized by an upward vertical integration where growers linked with juice production. Contrary to Brazil and Florida, this process in Mexico was

² Before 1990, a rapid replanting process had begun in Florida. The Florida Citrus Tree Inventory reported that year that the number of trees in the state exceeded 62 million, which was a record high. Production for the 1990-91 season was forecasted at 206.7 boxes. This production emulated that recorded in the 1979-80 season, before the freezes. (Spreen et al., 1992)

characterized by the participation of growers and processors working as two independent agents, with the latter competing aggressively against the fresh market for fruit. Juice processors in Mexico were not “linked” with the production of oranges prior to the establishment of processing plants. Instead (with a few exceptions), processors can better be considered as entrepreneurs with business ability and knowledge of finance. It took several years for the processing sector to understand the importance of the fresh market in Mexico and the internal competition it represented. Fruit procurement always has been a significant issue within the marketing chain of the citrus industry in the country. Consequently, the difficulties confronted by the processing sector were partially alleviated by incorporating into its structure, the services provided by intermediate agents called *coyotes*. These intermediaries play a significant role within the orange marketing channel in Mexico, to the point that the coyotes represent a strong influence in the process of price determination. It is particularly clear that coyotes affect transaction costs but also act as an important link between growers and processors.

As the Mexican processing sector evolved, a higher level of backward vertical integration between processors and growers is being observed in the country. This industry transformation is a necessary adaptation for the surviving plants. Those plants that are not integrated try to maintain varied marketing options to help to ensure their orange supply.

The Fresh Domestic Market

The price difference between oranges utilized for fresh consumption and oranges utilized for processing is the main reason for the discrepancy between the two markets. The pattern of average prices followed by the fresh and processed market during the period of 1990 to 2002 is demonstrative (Table 3.2). The processing industry has

maintained an average price that is about 50 percent lower than the fresh market, a difference due to the fact that oranges are primarily consumed fresh in the domestic market. The processing sector, however, has paid higher prices for fresh oranges during those years when frozen concentrate orange juice (FCOJ) production levels were high. Availability of fruit is also a factor determining the price paid by the processing industry. This behavior shows that the processing industry is heavily dependent on international FCOJ prices, and the domestic price for fresh oranges, which in turn depends on orange production. When a low supply of oranges in Mexico is combined with low international FCOJ prices, processing plants find it difficult to offer competitive prices for fruit to process. About 85 percent of the processing cost structure reflects the purchase price of fruit plus the cost of transporting the fruit to the juice plant (United States Department of Agriculture, 2000). High international FCOJ prices represent a significant factor in alleviating processing costs concerns. This suggests that the industry cost structure depends on the volume of orange juice that Mexico exports. When the demand for Mexican orange juice exports increases, the processing sector is able to pay a better price for oranges. At other times, when the industry is trying to compete with the international market by maintaining low costs of juice production, it offers low prices to growers. By the year 2000, some of the remaining processing plants began to plant their own groves, to ensure a continuous supply of oranges (United States Department of Agriculture, 2000).

As the orange juice industries of Florida and Brazil were expanding production, world orange juice prices decreased and the industry in Mexico offered lower prices for oranges. The fresh market offered better prices albeit with higher volatility, making it a

more attractive market for growers. As a consequence of this, the processing industry purchased the leftover or rejected oranges by the fresh market, creating difficulties in terms of fulfilling quality standards and anticipating the volume of production. It is clear that the internal fresh market is the strongest competitor with the Mexican processing even as these processors attempt to compete on the world market.

Table 3.2. Mexico. Orange production, prices paid for oranges at the fresh and the processing markets, FCOJ international price and FCOJ production 1990-2002.

Year	Orange production (a) (Tons)	Price of oranges at the fresh market (Pesos/Metric Ton)	Price paid by processors (Pesos/Metric ton)	FCOJ international price (Dollars/Lb)	FCOJ production in Mexico (Metric tons)
1990	2,220,338	450-900	120-220	N.A.	30,000
1991	2,369,492	450-600	200	N.A.	14,000
1992	2,541,487	800-1000	300-420	0.65	22,000
1993	2,913,686	350-450	130-150	0.75	36,000
1994	3,191,147	400-600	350-550	1.00-1.10	65,000
1995	3,571,541	350-600	280-500	1.10-1.16	45,000
1996	3,984,608	600-1300	800-1300	1.20-1.30	45,500
1997	3,943,858	500-800	250-500	0.73-0.77	45,000
1998	3,331,152	1500-2000	900-1300	0.90-1.06	70,000
1999	3,520,032	1500-1800	640-840	1.10-1.20	41,000
2000	3,885,000	900-1000	650-750	0.82-0.87	40,000
2001	4,000,000	600-800	350-450	0.70-0.75	45,000
2002	3,600,000	800-1000	400-550	0.80-0.90	36,000

Data sources: (a) Secretaría de Agricultura, Ganadería y Desarrollo Rural 1990-1999. United States Department of Agriculture, Foreign Agricultural Service, Attaché reports.

Distribution of Oranges in Mexico

There are three major wholesale markets or Centrales de Abastos in the country, which handle 80 percent of total oranges sold. The Central de Abastos in Mexico City is the largest in the country and handles around 40 percent of the sales. The two other large markets are located in Guadalajara and Monterrey. Orange distribution in Mexico ranges

from traditional distribution methods to methods that can be considered more sophisticated, such as distributors that operate at a national level. The development of new local wholesale markets, however, has been an important factor in reducing the role of traditional distributors.

Local wholesale markets are gaining more importance, as the volume of oranges they handle increases and prices received are more attractive than those established in Mexico City or any other larger city. Even if the price is more favorable in Mexico City, some distributors prefer to bring their oranges to the local market because of uncertainty and transportation costs. The importance of some local markets is such that the price that is set at these markets is considered as a reference for other central markets located along the country. One of these local markets is Idolos, located in the northern part of Veracruz. Residents and operators in this market ensure that wholesalers from larger markets gather to procure fruit. When interviewed, many buyers and sellers reported that Idolos represents the strongest market at a rural level in Mexico.

Despite the volume of oranges that are sold at this rural market and in other markets in Veracruz (Martinez de la Torre, Gutierrez Zamora, and Alamo), this state is the leading supplier to the Central de Abastos in Mexico City. This is partially explained by the fact that most of these oranges have already a buyer waiting for them or because distributors are encouraged by the capability of this market to handle large volumes of fruit. Veracruz is the leading producing state of oranges in Mexico with about 40 percent of national production.

The Central de Abastos in Mexico City was initially created as a place to bid on fruit. The idea was to create an auction-like market for the fruit, that would take part in

the so-called *Piso de Remates*, with the purpose of establishing a price that would directly benefit producers and consumers. Since most of the producers were not involved in the marketing of their products, intermediaries started benefiting from this role. Over time, these intermediaries have established a connection with individual distributors at the Central de Abastos where retailers, processors and lower-scale distributors gather to procure fruit. As the product is “transferred” among different participants in the selling process, price increases without benefiting the producer yet affecting consumers. Powerful wholesale-retailers promptly surpassed the main objective of the Central de Abastos. At present, as observed by the author during a visit to the Central de Abastos in 2000 (see Marketing Mechanisms section ahead) only a few retailers with previously established arrangements control orange wholesaling at the Central de Abastos in Mexico City.

Coyotes

Coyotes represent the most important intermediary group in the agricultural marketing system in Mexico. Although not viewed positively by most growers, coyotes play a primary role in terms of product assembly and pricing. In some cases, coyotes act as financiers to growers that have no access to bank credit. Since growers are not traditionally involved in the marketing process, coyotes participate in a complex system where they distribute fruit and determine prices. As an important link in the marketing channels for oranges, coyotes are the communication link between growers and the market. Coyotes have the capacity to hire pickers and separate fruit destined for the fresh market from fruit destined for processing. Due to their knowledge in terms of both the market and production, they often search for new production zones and alternative markets. (Mondragon et al., 1998).

New market structures within the citrus industry in Mexico are evolving as an alternative to reduce the role of coyotes and increase the participation of growers in the marketing process. A series of demonstrations on the part of farmers occurred to demand intervention by the federal government to reduce the intervention of intermediaries.³ The citrus industry in Mexico is in the process of consolidating through a national association that offers growers broader participation within the industry and major involvement in marketing their product. Although this effort may benefit the growers and the industry in general, the difficult financial situation confronting many orange growers in the country will remain as a factor supporting the continued presence of coyotes in the marketing system.

On the other hand, some of the surviving processing plants in Mexico are opting to backward vertically integrate into orange production. One of these processing companies is currently operating three orange groves with significant production to supply its own processing plants. Contrary to other processing plants with some indication of economic integration, this processing company predetermines its orange production to be processed at any of its three processing facilities. The other processing plants simply speculate with price and seek better revenues in alternative markets.

In order to better understand the economic and social implications of this new production and marketing structure in Mexico's citrus industry, a discussion is presented on the economics of vertical integration in the following section. Also some insights from

³ On December 12th 2002, farmers from all over the country formed a demonstration in Mexico City, threatening with incinerating themselves if the government does not intervene in the elimination of coyotes. Farmers claim that coyotes keep a major part of their revenues. Published in the newspaper Reforma. December 13th 2002.

new institutional economics are portrayed with emphasis on the Coasian firm as described by Coase in 1937.

The Economics of Vertical Integration

The movement of product from the initial stage of production to its acquisition by an end-user involves many different production and distribution functions. In principle, separate specialized firms could perform each of these functions or they could all be accomplished within the limits of a single, vertically integrated firm. For the case of the orange juice industry, the initial stage consists of purchasing of fruit to process. What this implies is that, for some firms, oranges and some other intermediate products that are used for orange juice production, are bought in the open market, while other firms procure fruit through explicit contracts of varying duration and complexity. Undeniably, any given transaction is expected to involve a mix of management structures, as when, for example, a firm purchase oranges in the spot market but enters into a long-term contract with a trucking company to transport them from the grower to the processing plant. In the case of a vertically integrated processing plant, this arrangement simply transfers oranges and intermediate products to its downstream division at suitable shadow prices.

The selection of one of these options is based upon which one is optimal (i.e. minimizes the sum of production and transaction costs) under given conditions of production. Such choices turn on many things that need to be considered: critical features of the transaction itself such as the frequency of recurrence, the level of investment in specialized assets, and the degree of uncertainty attending the exchange; technological interdependencies between the stages of production, location and availability of inputs. Since most of the firms have some of their intermediate process already inserted into the

production structure, it is said that all firms are vertically integrated to some extent. No firm, however, can be considered as totally integrated, as there might be some processes that are not transferable. What is more relevant is that the degree of vertical integration in the economy is not rigid (Shughart, 1997). A firm can adjust its degree of integration based on the market conditions such as variations in seasonal demands or changes in the pattern of consumption. As firms adapt to new technologies and to changing market conditions, a changing pattern of ownership integration is expected to be observed.

The Coasian Firm

To the neoclassical economist, the firm is effectively defined as a cost curve and a demand curve, and the theory is simply the logic of optimal pricing and input combinations (Slater, 1980). The firm is presented as an economic entity for purely technological reasons (scale economies in production) in neoclassical theory. For this reason, there are a series of questions that remain unanswered by this theory: Some economic activities are coordinated by an impersonal price system, and the managers of firms consciously coordinate some. A decision must be made in terms of deciding those economic functions that the firm will perform. In addition, the number of agents involved in any economic activity may differ with the structure and organization of the firm itself. Some vertically integrated firms will move their products under common ownership in a steady stream from the initial stage to the market. Questions about the elements in need of being considered to determine the size and organizational structure of the firm are also relevant. Furthermore, neoclassical theory does not provide enough elements to make a decision on the type of ownership arrangement that the firm will adopt.

The new institutional economic theory of the firm is an alternative to assist in answering these questions. This theory emphasizes that the determinants of integration

are not exclusively technological in nature, but at the same time do not deny the importance of technological factors in influencing the extent to which economic activities are integrated within the firm. This modern analytical structure about the theory of the firm proceeds from Ronald H. Coase's fundamental insight that "it is costly to rely exclusively on the price system to coordinate resource allocation decisions" (Coase, 1937, p.387). Coase's primary contribution to the theory of the firm followed from asking the question of why economic organizations came into being in the first place if a market price system already exists and one of its functions is to allocate scarce resources efficiently. The market is an entity that coordinates the production and distribution of goods by collecting information about resource values, broadly scattered over time and across space, and condensing that information into a set of relative prices that offers rewards (profits) to alert entrepreneurs who redirect resources from less highly valued to more highly valued uses (Coase, 1937).

At the interior of the firm, similar function are executed by the managers. They assign tasks, establish rewards, monitor performance, and coordinate production activities, but they do so without the benefit of explicit price and profit signals. Coase's approach considered that these two alternative methods of coordinating the allocation of resources exist because the use of either the market price system or internal organization imposes costs on the relevant decision makers. According to Coase, the firm emerges in an attempt to economize on these costs.

The Price System

One of the main virtues of Coase's theory is his identification of the cost of relying on the price system to allocate resources among alternative uses. Two agents (sellers and buyers) participating in a transaction on the open market confront a series of tasks before

accomplishing their role in the market. For instance, sellers must consider the characteristics and prices of the inputs that are going to be used in the production process; understand the preferences of consumers and seek to satisfy them; and, advertise their products to reach potential buyers. On the other hand, the buyer must consider price and evaluate the characteristics of the goods offered for sale, determine the physical location of the seller, and consider the service and warranty offered with the purchase of the product. In an attempt to find out relevant prices, both of these agents will incur in costs.

An alternative to the cost that these two agents realize in the process of acquiring information about prices is to establish a contract, which may vary in length. A contract, as Coase specified, entails costs of its own. If a contract is made with a long-term specification, the two parties can be attached to terms that might later be unfavorable. Here the economic cost of production can be compared to the opportunity cost generated by the contractual situation. Alternatively, a short-term contract with the need of being renegotiated requires the same sort of resources that were utilized for the initial negotiation.

Managerial Commands

Alternatives to market-based transactions are of course not free. Coase identified two costs of allocating resources by conscious command that limit the scope of the firm:

1. Decision-making costs rise as additional transactions are removed from the market and placed under management's control. Planning becomes more complex and more costly as the number of activities to be coordinated increases.
2. As the number of transactions organized within the firm grows, there is a greater risk of failing to make the best use of productive resources. The increasing costs of planning and coordination, which Coase described as representing decreasing returns to the entrepreneurial function, are analogous to the diseconomies of scale and scope that limit firm size in the neoclassical model.

The Optimal Firm Size

According to Coase, a firm will tend to expand until the costs of organizing an extra transaction within the firm become equal to the costs of carrying out the same transaction by means of an exchange on the open market or the costs of organizing another firm (See Figure 3.2).

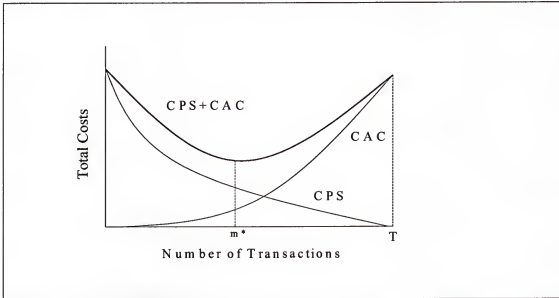


Figure 3.2. The costs of resource allocation in the Coasian firm

In figure 3.2, the vertical axis represents the total costs that a firm incurs in the process of production, whereas the horizontal axis represents the number of transactions that are executed by the firm in order to complete this process. CPS is the Cost of the Price System and equivalent to the price paid by any transaction in the market external to the firm. If a firm acquires its entire product from an external market, the cost associated with such transaction is the maximum that the firm can have. This cost is associated with a firm that is contracting all of its transactions in the price system. As the firm moves to T, a greater number of transactions are being internalized with a significant reduction in total costs. At T, total costs are zero because the firm has internalized all of the transactions into its own structure of production. Internalizing transaction, however,

entail a restructure at the interior of the firm. The Cost of Administrative Command (CAC) curve starts rising with every transaction that is retrieved from the price system to be reinstalled in the interior of the firm. For this reason, when the firm does not execute any transaction in the price system (point T), CAC is at the maximum. So, up to what extent should a firm internalize transactions? In Figure 3.2, the curve $CPS+CAC$ is given by the vertical sum of CPS and CAC. The minimum point of these two types of costs indicates the optimal structure of the firm. This point is given by m and is projected to the number of transactions that a firm should internalize in order to operate efficiently. Any deviation from m will represent an extra cost for the firm, resulting in inefficient operation.

Vertical Integration (Revisited)

Why would a profit-maximizing firm want to integrate vertically into an upstream or downstream market? First, allocative efficiency often supplies a key motive for combining successive stages of production under common ownership. Substantial cost savings can be achieved by eliminating market-based input-price distortions. By replacing market transactions for an input where price is greater than the marginal cost associated with internal transactions, the vertically integrated firm is able to produce the same quantity of final product at a lower cost or, for the same budget, to expand final product output and reduce final product cost.

Similar cost saving opportunities can be exploited by using vertical integration to insulate market transactions from government tax or regulatory policies and to reallocate risk to the party most willing to bear it. Transaction-cost savings supply another motive for vertical integration. In this regard, bringing a market transaction inside the ownership

boundaries of the firm helps limit post-contractual opportunistic behavior and provides incentives that help overcome informational asymmetries between buyer and seller.

A second implication of the economic theory of vertical integration is that common ownership of successive stages of production by itself can neither create horizontal market power nor increase or extend it from one stage of the production process to another. Any increase in horizontal market power at one or both stages of production that may occur in conjunction with vertical integration is a horizontal, not a vertical, matter. Third, in the exceptional cases in which vertical integration is accompanied by an increase in horizontal market power, as when an input monopolist acquires substantially all of the firms in a downstream consuming industry, the anticompetitive effects are combined with cost-reducing effects. The analysis of such cases requires a balancing of welfare gains and losses.

But the efficiency benefits of vertical integration can often be achieved by other means. As Coasian tradition teaches, while removing a transaction from the market reduces the cost of using the price system to allocate resources, it raises the cost of internal-to-the-firm decision making. Planning becomes more complex as the number of activities to be coordinated increases. Errors in assigning tasks, establishing rewards, monitoring performance, and so on become more likely as the scale of the firm increases and its scope expands. Ownership integration is therefore profitable only if the savings realized by placing less reliance on market exchange exceed the additional costs of administrative command.

In other words, an alternative to vertical integration can be given by external contracting. This is also a transaction-cost reducing alternative and may have the same

effects as vertical integration in a wide range of cases. Later in this chapter, the economics of contracting is analyzed with specific attention on citrus marketing. But before that, it is necessary to review the history and implications of land tenure in Mexico. This will help understand why this marketing alternative as well as others that currently exist in other citrus producing regions of the world cannot be directly applied to the citrus industry in Mexico. Needless to say, however, land tenure itself is not the only factor that merits attention. Certainly there are other elements that can explain coordination problems between production and utilization of oranges in the country. It is the land, though, where the initial process takes place and much of the coordination between the two stages of orange juice production is failing. Although no significant changes have been observed, the Mexican government started a new land reform with the intent of transforming agricultural production. Under the reform, ejidatarios have been granted full title to the land they have been farming. They now can use that land as collateral for credit. Changes to the Mexican Constitution, specifically to Article 27, were one of the major challenges that the government had to confront in order to compete in the new global economy. Following is a review of the conditions under which reform needed to take place.

The Need for Reformation

Since 1917 the Mexican government has assumed the responsibility of planning, coordination and orientation of the agricultural policy to define the future of millions of Mexicans whose source of income depend on agricultural activities. A major consequence of the revolution in 1917 was that the government expropriated large holdings of land held by approximately 20 families. Land reform allowed private ownership but placed strict limits on the amount of land that could be owned by

individuals. While privately owned land still exists in Mexico, a new kind of ownership arose with the reformation. Individuals were granted rights to farm a piece of land called ejidos. The people, called ejidatarios, would “posses” this communal property. Even when different governments pronounced a particular perspective about the ejido, few structural reforms were made until 1988 when Carlos Salinas de Gortari was elected president of Mexico. Other than conceptualizing the ejido as a “complement to salary or as a transitional property towards the [general application] of the structure of the small rural private property, the political style applied to the agricultural sector was the same” (Muñoz and Santoyo, 1996 p.4).

The so-called *Reforma Agraria* (Agricultural Reform) in Mexico was conceived as a social policy implemented to prevent social conflicts without being transcendent in terms of agricultural production (Muñoz and Santoyo, 1996). As such, the government-farmers relationship has always been characterized by a profound dose of tutelage, paternalism and patronage. In order to maintain legitimization, the government utilized a series of political mechanisms such as land distribution, credit, health security and the guaranteed purchasing of products. These mechanisms resulted in a characterization of the ejido as an appendage of the government, without proper autonomy and subject to the direction given by the governmental group in power. This economic model was functional because the country was acting in a closed economy and oil enjoyed high international prices and excellent export opportunities. The government was able to subsidize the purchase of inputs and services throughout a net of agricultural enterprises and institutions, and also international financial organizations assigned significant loans to the country.

With the opening of the economy, however, support systems became difficult to sustain. Oil prices started to decrease, public enterprises were privatized, and access to international credits was impeded due to a crisis provoked by Mexico's international debt situation (Cornelius and Myhre, 1998). Under these circumstances, the government was unable to maintain the structure of dominance represented by the ejido. Public resources were now insufficient to maintain the inexhaustible scheme of political patronage.

The political agenda contained in a letter addressed by President Salinas to the Congress registers the beginning of one of the most controversial debates in the new era of politics in Mexico: an initiative to reform Article 27 of the Mexican Constitution. The initiative roughed out the start of a new relationship between the government and farmers, based on the abandon of the tutelage, paternalism and patronage active since 1917. This fact was considered an evisceration of the government as promoter of rural development in Mexico at the same time that it granted more freedom to farmers.

Among the principal factors justifying the initiative to reform Article 27 were:

- Most of the farmers possessed less than five hectares of cultivable land. Added to this land limitation are the restrictions that lower the farmers' autonomy and their organizational ability to establish associations.
- There were no incentives for capital investment given the uncertainty of land possession.
- Public investment did not have the necessary magnitude to support modernization of agricultural production, which was needed. More sources of investment were required.
- The agricultural sector had been highly susceptible to economic instability, inflation, and variations in the exchange rate. Under these circumstances, technological advances in production and marketing were unable to affect this sector. This factor implied a reduction in the competitiveness of the agricultural sector.
- Ejido lands were illegally sold or rented to a third party or association. This was a clear indication of the need to regulate a generalized practice among the farmers.

It was at this point that the government understood the response of farmers to conditions of poverty and to the difficulty of accessing credit, technology, and profitable scales of production.

Notwithstanding the strong opposition from rural communities, the reform of Article 27 was published on January 6th 1992 in the *Diario Oficial de la Federacion*, government's official newspaper (Secretaria de Gobernacion, 1992). The reform was stated as an attempt to transform agricultural production and provide more freedom and security to farmers. The concern raised by rural communities was based on the belief that in the future they would become workers on the land (peones) and not owners (Diario Reforma, Jan. 1992). Unquestionably this event marked the end of the reparto agrario (granted land) as an unlimited obligation of the Mexican government and the beginning of a new era where the ejido and the agricultural communities received autonomy in terms of deciding the best way to use the land (Vale, 1992).

When the reform was made in 1992, half of the national land area was either designated as an ejido or a community. A community is an organization very similar to ejidos but involving more than one member. The reparto agrario lasted more than 70 years and gave away more than 27,000 ejidos distributed across the country and accounting for more than 100 million of hectares (Secretaría de la Reforma Agraria, 1997).

Yet, today the land structure in Mexico has not changed as the government predicted. The number of ejidos is still considerable and those that have been sold are being displaced from agricultural uses (Cornelius and Mhyre, 1998). Technological

investment has not occurred on the scale considered possible and agricultural production has demonstrated no significant change (Snyder and Torres, 1998).

The composition of ejidos among the main citrus producing states in Mexico varies considerably (Table 3.3) based on number of hectares per person and hectares devoted to agriculture. The remarkable difference in the percentage showed for Veracruz, the leading citrus producing state in the country, and Sonora, might partially be explained by production costs. While agriculture production in states like Sonora and Nuevo León is about 85 percent irrigated by well water, in Veracruz this mode of production represents less than a 10 percent (United States Department of Agriculture, 2001). Most of agriculture production in Veracruz is non-irrigated. Veracruz and Sonora, however, maintain the same structure in terms of the number of hectares per person, which contrasts with states like Tamaulipas and Campeche where the average landholding is greater than 8 hectares per person but ejidos account for a low percentage devoted to agriculture. Alternative uses given to the land cannot be homogenized among different states.

Table 3.3. Mexico. Ejido structure in the major citrus producing states, 2000

State	Average landholding (a) (hectares/person)	Percentage devoted to agriculture
Nuevo León	6.7	12
Tamaulipas	10.6	33
San Luis Potosí	5.9	21
Veracruz	5.5	46
Sonora	5.5	7
Tabasco	4.7	23
Campeche	9.0	11
Yucatán	4.7	26

Note: a) Total hectares in the state divided by population in the state. Data source: Secretaría de Agricultura, Ganadería y Desarrollo Rural, 2000.

The Ejido and Citrus Production in Mexico

Spreen et al. may have made the best description of the need for reformation back in 1992 (Spreen et al., 1992). Their description of citrus production in Mexico states that citrus groves in ejidos are small, within the range of 2 to 25 acres (approximately 1 to 10 hectares). They present ejidatarios as peasants and not well educated. Since this factor limits the possibility of understanding the agronomy of citrus production or ejidatarios access to technical assistance, yields in ejidos are typically low. Their analysis also refers to privately owned groves as larger and better managed than ejidos but emphasizing the limits on grove ownership of 100 hectares for irrigated land and 200 hectares for non irrigated land.

In another assertion, these authors confirm that the land tenure system discourages investment in land improvements. This argument is based on the fact that seizing of land by squatters is still evident in Mexico. Regardless of individuals holding title to a portion of the land, several organizations are devoted to exercising taking of land as a legitimate procedure under. Their plea is that they did not benefit by receiving a portion of land as promised during the *reparto agrario*. Eviction of squatters by legal means is not warranted and sometimes ejidatarios would accept the fact as irreversible. For this reason landowners are still reluctant to make long-term investments of any kind that may improve citrus productivity on their farms and production in the country.

Integration of the Citrus Industry in Mexico

Vertical integration of the orange juice processing industry in Mexico is taking place under two particular characteristics. First, its degree of integration has a tendency to be total, that is, the processing industry is seeking to eliminate any dependency with the fresh market. As demonstrated before with the analysis of the Coasian firm, a process

where integration is taken to the extreme may result in significant costs that are not efficient for the firm. The degree of integration should be decided only under the basis of cost analysis and Coase's theory can be utilized for this purpose. It might be possible that the processing industry in Mexico still will need to acquire some oranges from the fresh market, or better yet, directly from producers, which can be subject to a marketing arrangement as formulated in the following section. It is true that producers are small and many of them are needed to fulfill the requirement of fruit by the processing industry but a combined strategy of integration and a marketing arrangement may be more efficient than either of these forms of fruit procurement applied independently.

Secondly, rather than integrate orange production into the structure of the firm, the processing industry is creating a parallel industry. Since orange trees start bearing fruit at four or five years of age, this process requires more time. In addition, the industry is utilizing more economic resources--and hence more capital--in an effort to develop its own orchards. According to information revealed by the processing industry in Mexico, most of the lands acquired were in cattle production before being converted into orange groves. More importantly, the processing industry started this process of "integration" as a reaction to marketing conditions. Because of the delay inherent in such integration, circumstances in the international market are no longer what they were when this policy was initiated. Lower world prices in today's markets may not support the costs of complete vertical integration.

Similar to the establishment and evolution of the processing industry in Mexico, the process of vertical integration seems to be unsupported by a theoretical framework. There is no evidence of scientific analysis undertaken by the industry to respond to the question

of the degree of integration. The industry simply has responded to its overarching need to ensure a constant supply of oranges without any other considerations.

Evidence has shown, though, that vertical integration is not the only mean to achieve efficiency. Fruit procurement can be accomplished by marketing mechanisms that do not necessarily require involvement with production. These marketing mechanisms have proven their effectiveness as they are commonly utilized by other citrus industries all over the world. An analysis of these marketing mechanisms follows as an alternative to the economics of vertical integration.

Marketing Mechanisms

A primary premise of this paper is that the poor coordination that exists between growers and processors in Mexico has been one of the main factors explaining the contraction of the processing industry in the country. The non-diversification of mechanisms to procure fruit by the processing sector has placed this sector in fierce competition with the fresh market for its main input.

As part of this research, a trip to Mexico by the author was made at the end of the year 2000. The main objective of the trip was to attain a better understanding of the current situation in Mexico's citrus industry. A visit to the Central de Abastos in Mexico City was scheduled, to witness the marketing process for oranges. Several coyotes were interviewed. Governmental authorities directly involved with the citrus industry in Mexico were also interviewed.

The field research also included a series of visits to processing plants located in Veracruz and Tabasco as well as some of their own orange groves that were under development at that time. A total of five plants were visited. Two of the largest processing plants in the country, which are located in the municipality of Martinez de la

Torre in Veracruz, were included. Both were in the process of being certified to export their product to Asia and Europe. Two other plants that were visited in Veracruz are currently shut down because of financial problems.

In all of the plants interviewed, however, the lack of fruit to process was one of the more recurrent phenomena observed during the visits. Those plants with oranges to process used product from their own groves and some that was diverted from the fresh market with the help of coyotes. No systematic delivery of fruit was scheduled at any of the plants and in many cases, personnel was waiting for trucks to arrive in any moment. Although no data were obtained to quantify the operational costs associated with delays in delivery of oranges to process, some plant administrators mentioned that they are very significant. The uncertainty of production in terms of volume and quality has been a major limiting factor in establishing commercial agreement with international buyers. Concentration of the industry in Mexico may be criticized but at the same time exposes an example of good administration and knowledge of the different existing economic alternatives to linkage stages of production.

The following section deals with the specifics of these marketing alternatives, specifically for those that are currently being used in the citrus industry of Florida. The analysis is left to be considered by independent parties within the citrus industry in Mexico. For each one of these alternatives, a reflection is made in terms of its price risk implications and return on investment. An attempt to describe the advantages and disadvantages of each one of these marketing mechanisms is also included.

Existing Marketing Mechanisms

Marketing mechanisms represent an alternative for processors to pursuit fruit.

Currently, there are several forms of fruit procurement that are implemented in the market but the most common are the following:

- Spot market (Cash Market)
- Multi-year fixed price
- Participation plans
- Cooperatives.

Spot market. This marketing mechanism is characterized by pricing the fruit at the time of harvest or delivery. The price received is set by the buyer and normally is based upon the quality of the fruit at harvest time. This fact implies non-commitment of the fruit to any buyer prior to this time. The price offered by the buyer is usually related to the market situation and to specific needs of the buyer who can be any purchasing agent related to the fruit.

The spot seller's economic returns maintain an inverse relationship with market supply. Thus, when sufficient inventories exist at the processing level and the crop size is normal, the price offered to the seller will be at a considerable discount with respect to other alternatives. In times of shortage of fruit or when demand substantially changes, it is expected that the spot seller's return will be at a premium with respect to the other mechanisms.

One of the major advantages of the spot mechanism is that payment for fruit priced at delivery is immediate. This part of the arrangement is particularly attractive to those sellers in need of cash who cannot withstand the payment delay imposed by other alternatives. There is, however, a difficulty that should be further considered. Since destination for the fruit has not been assured, decisions on harvesting and delivery can be

out of the scope of grower, representing a high level of price risk that has to be borne by the grower.

In Mexico, selling oranges in the spot market is the prevailing marketing mechanism. Often fruit is procured at wholesale markets where agents working for the processing plants try to obtain some fruit to be processed. These agents are called *coyotes*, and they perform a task similar to the one bird dogs perform in Florida. There are many kinds of coyotes in Mexico and they can be distinguished in terms of their procedures. All of them, however, play a major role in fruit distribution. Some independent coyotes own the infrastructure to harvest and transport the fruit to rural assembly markets. Wealthy coyotes possess enough cash so they can make the transaction at the crop site and harvest the fruit. Coyotes with a different *modus operandi* also procure the fruit that is allocated in the different wholesale markets.

The reason for popularity of the spot market is that the implementation of contracts or any other mechanism implies considerable transactions costs. To be able to fulfill the requirements of a processing plant, processors need to establish arrangements that involve more than one orange grower. Because of the land ownership structure, any individual grower is incapable of satisfying the demand for fruit by the processing plant. In addition, the culture of contracts is not well developed, implying that contracts are not always fulfilled.

Multi-year fixed price contracts. External contracting, in a number of circumstances, is a transaction-cost reducing alternative to vertical integration. Firms that are not able to integrate may opt for contracting to “internalize” a production process

that is out of the firm's scope. Contracts can be specified in different length of time and entailing particular compromises that concern to the firm.

One of the forms a contract may acquire is a multi-year fixed price contract. This marketing mechanism is a guarantee by the processor or first handler that it will buy all of the fruit produced from an individual grower for the duration specified in the contract. The price established may be a constant price over the life of the contract or establish a price floor coupled with an escalator, called the "rise". This rise is usually half of the increment in prices during the period specified in the contract. The advantages that this mechanism has are: the establishment of a home for the fruit, that growers are normally paid soon after harvest, and the establishment of a minimum fruit price. Some of the disadvantages of this mechanism are: the inability to fully participate in good markets and the need to renew contracts (transaction costs); and the price floor established in this form of contract is generally strongly influenced by current market conditions. Therefore, if the contract is renewed in a bad price year, the price floor may be too low. This condition, however, may act in favor of the grower in good price years.

As mentioned before, in Mexico the existence of contracts is very limited. One of the reasons is that production of oranges in the country is fragmented by the land structure, which is still generally composed of small ejidos, making transaction costs a significant factor in the cost of juice production. The fierce competition from the fresh orange market obligates some juice processors to seek better ways to ensure supply of fruit. In this respect, many processing plants have "signed contracts" with growers in spite of risk associated with lack of contract fulfillment, insecure verbal commitments, and the existence of duplicity in the arrangement. To ensure the fulfillment of the

contract, many processors and growers request the intervention of a public notary to certify the transaction.

Participation plans. When the marketing process is referred to a mechanism in which price is determined only after the product is sold, the mechanism is called a deferred pricing alternative. The case of a participation plan is a particular one where an arrangement between growers and handlers is made, and the fruit is pooled after the grower commits all of his production to the representative of the plan. Similar to the functioning of a cooperative in many aspects, this mechanism has the major advantage of ensuring a home for the fruit. Since the grower does not “own” the physical assets of the organization (as in a cooperative), there are no retained profits that need to be returned to the grower. The main characteristic of this marketing alternative is that the price is established with a significant time delay after harvest, mainly when juice is sold. As a consequence of this, the final price cannot be guaranteed. The grower is limited in many aspects of the marketing process (harvest-delivery) and remains as the residual claimant who bears the risk of price changes (Ward and Kilmer, 1989). Thus the main disadvantage of this mechanism is that price risk is still present and depends upon the marketing process as well as the price determination process utilized for the pool. If capital is in short supply and financial markets unresponsive, the delay may also cause cash flow problems for some participating firms.

Cooperatives. A cooperative represents more direct involvement of growers into the marketing process of their fruit. Here growers are more closely linked to consumers and can better understand their preferences. A cooperative assures a destination for the fruit and diminishes the concerns about the delivery time and pricing. Since the fruit is

pooled with that of other growers, a common price is paid; but there is still a price risk and the grower does not maintain control over the price received for the fruit. Because of this average price, however, it is said that the grower faces less price risk compared to cash sales. The cooperative also provides some services that must normally be covered by the grower. When the final product is sold, some of the earnings are retained to cover expenses of the cooperative. In some cases, some cooperatives may also retain a portion of the payout in order to establish a capital base. The grower will receive the price difference after deductions have been made and according to his contribution to the pool.

The payment system distinguishes the cooperative from a participation plan. In a cooperative, the growers are in possession of the physical assets of the organization and they must maintain the organization. Given the democratic approach to general management of a cooperative, growers are given appropriate representation in the major marketing decisions and processes. Thus, cooperative group action provides an added degree of market power to the cooperative's members and they have collective decision authority. If the cooperative accumulates capital beyond its needs, dividends can be advanced to members on the basis also of fruit volume participation.

Cooperatives in the Mexican citrus industry are not common, in particular inside the orange industry. Most of the cooperatives operating in the citrus industry in Mexico are located in the Persian lime market where members usually deliver their fruit to a packinghouse. At the packinghouse, the product is graded and classified to comply with specifics of the domestic or international market. Some other agricultural commodities in Mexico have operated under the structure of cooperatives: sugar cane, coconut and banana in the state of Tabasco, and the almost extinct henequen industry in Yucatan.

Recent attempts to form an unprecedented organization in the orange industry might result in the formation of smaller cells of organization, with the same benefits of a cooperative.

Final Comments

The economics of vertical integration represents a valuable tool that may be utilized to determine the efficient point of vertical integration. This point, also known as the optimal size of the firm, is given by the minimum sum of CPS and CAC, and it is identified as the stage where operational and transaction costs are at the minimum. Consistent with the Coasian theory, any deviation from this point might represent an inefficient state of production for the firm. Considering this, the Mexican processing industry should carefully consider an analysis like the one proposed here to evaluate the impact of such integration. Vertical integration does not represent a solution in itself if its degree is not specified. Total integration of the industry can be as inefficient as it is the total dependency on the price system.

Alternatives to vertical integration were given at the end of this chapter. These marketing mechanisms require an improvement in coordination between processors and orange producers. Variables such as price and quality can be considered as part of a discussion in setting an arrangement between both parties. It should be mentioned, however, that these mechanisms have less possibility of succeeding if lack of coordination persists. There is room for improvement in the marketing process for oranges in Mexico and some of these changes have been already started to take place. Expectantly, these structural changes will lead the industry to a better position of competitiveness and presence in the world orange juice market.

CHAPTER 4

THE NORTH AMERICAN FREE TRADE AGREEMENT

The North American Free Trade Agreement (NAFTA) was implemented on January 1, 1994. The main objective of this agreement is to create a free-trade zone among the United States, Canada, and Mexico within a period of fifteen years. As such, this year the agreement is entering its tenth year of operation. While the process of tariff elimination continues, several changes are experienced inside the political and economic structures of the three participating countries. More specifically, the bilateral relationship between Mexico and the United States (U.S.) emerges as one of the largest developed-developing country trade relationships in the world.

The dramatic expansion of trade between Mexico and the United States has resulted in Mexico becoming the second largest export market for the United States, while the United States is Mexico's largest export destination. Just prior to NAFTA, Mexico was the third-largest trading partner to the U.S. after Japan. During the period of 1993 to 1999 U.S. exports of goods to Mexico grew by over 109 percent, exceeding the rate of any other export market (Huenemann, 2001). If this trend continues, it would not be surprising that, within few more years, Mexico will become the largest trading partner for the United States, both for imports and exports. What this situation might represent for both countries is not yet completely clear, but certainly entails a series of new challenges and more importantly, it invites a forward look into the agreement as tariffs and other trade barriers are further reduced.

One major polemic contested in the NAFTA negotiations, besides those associated with sugar and high fructose corn syrup (HFCS), was the debate over the U.S. orange juice tariff. Since Canada is not a citrus producer, and the United States and Mexico rank as the world's second and third largest orange juice producers, respectively, it is not surprising that citrus in general, and orange juice in particular, was the topic of intensive negotiations. Both countries were seeking the opportunity to maintain the major tariff protection afforded domestic producers of citrus. As a result, a complex side agreement on citrus, without parallel for any other commodity (except possibly sugar) was incorporated into NAFTA. With only five more years remaining in the process of tariff elimination, it is worthwhile to analyze the role these two countries will play within the orange juice world market. This chapter provides an analysis of the market for processed oranges in the United States and Mexico.

The World Orange Juice Industry

World orange juice production is largely dominated by Brazil, followed by the United States. These two countries account for more than 85 percent of total orange juice production. In particular, the states of Sao Paulo in Brazil and Florida in the United States are the dominant producing areas for orange juice. Mexico is the third largest orange juice producer in the world. Its share is small, however, when compared to that of Florida and Brazil. Mexico contributed only 1.6 percent of world orange juice production during the 1998-1999 season. Other producing countries are Israel, Spain, Costa Rica, Belize, and Cuba.

The most important orange juice markets are the United States, Canada, Japan and the European Union, specifically the Netherlands, Germany, France and England. These countries together represent almost 90 percent of total world imports. The recovery of the

orange industry in the United States, after a series of devastating freezes that reduced production during the 1990's, has been significant. Presently, the United States is nearly self-sufficient in orange juice, and it exports small quantities of orange juice, mainly to Canada. Contrary to the U.S., Mexico's orange production is mainly destined to the domestic market. Since orange juice consumption in Mexico is not significant, most of its production is exported to the United States. During recent years, the European Union also has become an important market after a trade agreement that was signed in 2000.

The Orange Industry in Mexico

The orange industry in Mexico dates back to colonial rule under the Spanish. The freezes of the 1980s that destroyed millions of citrus trees in Florida and Texas also devastated the traditional citrus production region in the state of Nuevo Leon in northeast Mexico. The supply shortfall resulted in high prices for oranges and orange juice, which motivated a large-scale industry expansion in Mexico, especially in the more southern states of Veracruz and San Luis Potosi. Mexican producers now favored by this lack of supply in the U.S. market, expanded the orange production area from 138,000 hectares in 1980 to 360,000 in 1998. To date, orange production in Mexico has expanded and practically covers the whole country but the total planted area has been reduced to 242,000 hectares.

Processed orange production also responded to high market prices and in 1990 Mexico exported 83,000 metric tons of FCOJ to the U.S., Canada and Europe. The rapid expansion of the Mexican orange industry was a motive of concern for orange growers in Florida who demonstrated strong opposition to NAFTA. The agreement was signed under one of the longest tariff elimination periods considered in NAFTA and, in particular, a no-linear phase-out process was implemented. For Mexican orange growers, the signing

of NAFTA was considered a fundamental need for their industry because for many years the U.S. import tariff on Mexican orange juice was believed to be a major restriction for their exports. Since NAFTA implementation, however, the Mexican citrus industry has not yet shown the anticipated surge in its exports to the U.S. market (Figure 4.1).

For the most part of the years after NAFTA was implemented, processed utilization of oranges in Mexico has remained invariable. The exceptions are given by the 1994-95 and the 1997-98 seasons. These two seasons, as explained in chapter 2, responded more to favorable FCOJ international prices and the economic devaluation of the peso against the dollar than to the specifics of the trade agreement (see Spreen, 1996). Even when orange production increased for the 1998-99 season, processed utilization diminished by almost 50 percent with respect to the previous season. While utilization by part of the fresh market recovered to previous levels after the 1998-99 season, processed utilization returned to those corresponding to 1988-87. After 1995, Mexico started to import significant amounts of oranges into the country (Table 4.1).

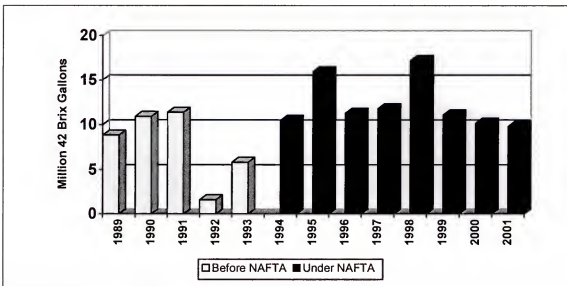


Figure 4.1. Mexico. FCOJ exports to the U.S. market 1989-2001.

Table 4.1. Mexico. Orange production and utilization, 1987 through 2000-01

Season	Availability			Utilization	
	Production	Imports	Exports	Fresh	Processed
.....1000 metric tons.....					
87-88	1942	0	9	1542	400
88-89	2269	1	8	1925	344
89-90	1903	3	3	1433	470
90-91	2301	1	25	1911	390
91-92	2101	1	10	1951	150
92-93	2701	1	3	2481	220
93-94	3175	1	2	2835	340
94-95	3571	1	10	2821	750
95-96	3600	10	8	3150	450
96-97	3931	14	11	3481	450
97-98	3915	15	9	3265	650
98-99	3922	19	50	2469	360
99-00	3417	32	11	3007	410
00-01	3522	22	19	3192	330

Source: Foreign Agricultural Service, USDA

The Tariff Rate Schedule Under NAFTA

Before the implementation of NAFTA, the United States imposed a tariff of 35 cents per single-strength equivalent (SSE) gallon for imported frozen concentrated orange juice (FCOJ) from those countries with Most Favored Nation (MFN) status. When NAFTA negotiations were discussed, this tariff was taken as a departure point for the 15-year phase-out process of the U.S. tariff on Mexican orange juice imports. The final form of the NAFTA establishes three classes of imports: quota, over-quota, and snapback. The quota for the first 15 years of the agreement is 40 million SSE gallons of FCOJ and four million SSE gallons of single-strength orange juice (SSOJ), also referred to as not from concentrated (NFC) orange juice. Over the period of 1994 through 2005, the first 40 million SSE gallons of FCOJ and the first four million gallons of SSOJ will be assessed 50 percent of the MFN tariff prevailing in 1994, equivalent to 17.5 cents per SSE gallon. FCOJ imports in excess of 40 million SSE gallons will be charge the over-quota rate,

which will be reduced over a 15-year period. For the first five years, the over-quota tariff was reduced 15 percent, remains unchanged during these five years, and it will be reduced to zero over last five years of the agreement. The distinction between quota and over-quota tariff will end in the 12th year of the agreement since the over-quota rate will be reduced to less than 50 percent of the prevailing 1994 MFN rate.

On November 3 1993, a renegotiation of the agreement resulted in the third category of import rates called the snapback. The snapback, considered an attempt to protect Florida producers from surges in Mexican FCOJ imports (Spren and Mondragon, 1996), is a mechanism based on volume and price. The volume mechanism is activated if total Mexican imports exceed 70 million SSE gallons during the years 1994 through 2002, and rises to 90 millions SSE gallons for 2003 through 2007. The price mechanism is activated if for five consecutive days, the daily closing price for FCOJ on the New York futures market falls below the most recent five-year monthly average futures closing price for the same month, without including the highest and lowest monthly closing averages for the same five-year period. Neither the volume nor the price mechanisms have been activated yet. The tariff rate quota schedule for imported Mexican orange juice under NAFTA offers some particularities. For instance, the in-quota schedule for FCOJ remains invariable for 12 years and then is reduced by almost 50 percent in 2006 and then again in 2007. The over-quota tariff has a similar schedule: it will remain constant until 2003 at a tariff rate of 29.7 cents per single strength (SSE) gallon of FCOJ and then in 2007 will match the in-quota tariff rate. Finally, the snapback for FCOJ remains invariable since 2000 and for SSOJ remains invariable since 1996. No other tariff elimination considered in NAFTA has this non-linear schedule (Table 4.2).

Table 4.2. Tariff rate quota schedule for imported Mexican orange juice under NAFTA

Year	FCOJ			SSOJ		
	In-Quota	Over-Quota	Snapback (a)	In-Quota	Over-Quota	Snapback (a)
	Cents per SSE gallon.....					
1994	17.5	34.1	35.0	10.0	18.7	18.7
1995	17.5	33.3	34.1	10.0	17.4	17.4
1996	17.5	32.4	33.2	10.0	16.1	17.0
1997	17.5	31.5	32.4	10.0	14.7	17.0
1998	17.5	30.6	31.5	10.0	13.4	17.0
1999	17.5	29.8	30.6	10.0	12.0	17.0
2000	17.5	29.7	29.7	10.0	10.7	17.0
2001	17.5	29.7	29.7	9.4	9.4	17.0
2002	17.5	29.7	29.7	8.0	8.0	17.0
2003	17.5	29.7	29.7	6.7	6.7	17.0
2004	17.5	23.8	29.7	5.3	5.3	17.0
2005	17.5	17.8	29.7	4.0	4.0	17.0
2006	11.9	11.9	29.7	2.7	2.7	17.0
2007	5.9	5.9	29.7	1.3	1.3	17.0
2008	0.0	0.0	29.7	0.0	0.0	17.0

Source: North American Free Trade Agreement, Office of the U.S. Trade Representative.

(a) The tariff applied to imports from Mexico exceeding 70 million SSE gallons from 1994 through 2002 and to imports from Mexico exceeding 90 million SSE gallons for 2003 through 2008 if a price mechanism is activated.

The Uruguay Round of the General Agreement on Trade and Tariffs (GATT) was concluded in 1994. The United States adopted the recommended provisions in 1994 and placed them into effect beginning January 1, 1995. The agreement for the United States, which was considered a major orange juice importing country at that time, was to reduce its import duty on orange juice by 15 percent over a six-year period beginning January 1, 1995. This 15 percent decline in the U.S. FCOJ tariff turned out to be very similar to the tariff reduction specified in NAFTA. Under NAFTA, the over-quota tariff declined by 15 percent over the first five years of the agreement. Under GATT, the most favored nation (MFN) FCOJ tariff declined by 15 percent over the six-year period commencing January 1, 1995. The discrepancy resides in the fact that the MFN tariff on FCOJ in year 2000 was 29.7 per SSE gallon, which is a 15.1 percent decrease. The original NAFTA tariff

included a tariff of 29.8 cents per SSE gallon for FCOJ imports from Mexico that exceeded the 40 million SSE gallon quota.

The existing difference between the NAFTA schedule and GATT was eliminated through modifications in the NAFTA tariff schedule. These modifications are mainly reflected in the over-quota and snapback schedules. In the over-quota schedule, the tariff is 29.8 cents per SSE gallon in 1999 and is 29.7 cents per SSE gallon over the period 2000 through 2003. In the snapback schedule, the tariff is reduced according to the GATT guidelines by 15.1 percent over the six-year period that began in 1995. In 1995, the volume trigger for the snapback tariff increases to 90 million SSE gallons. In 2008, all tariff on orange juice imported from Mexico will be eliminated.

The implications of the tariff rate quota schedule for the Mexican orange juice industry have been significant. Domestically, the processing industry has confronted a dilemma of uncertainty and lack of coordination with the fresh market. Internationally, the industry is facing an exhaustive tariff rate quota schedule that, so far, has not permitted to increase its participation into the U.S. orange juice market.

Most of the economic analysis made with respect to the Mexican orange juice-processing sector in the context of NAFTA, are specifically referred to an evaluation of the previous years. In addition, no objective economic mechanism has been utilized to quantify the impact of NAFTA in the processing industry. For this reason, the following section presents an objective analysis of the trade implications of the North American Free Trade Agreement in the orange juice industry in Mexico and the U.S. The analysis is conducted with the use of a mathematical model, which helps to predict the position of this industry in Mexico after the tariff rate quota schedule is completely removed.

The General Model

The first existing spatial equilibrium model is attributed to Stephen Enke, who in 1951 considered a descriptive analysis of trading one good among several spatially separated markets (Enke, 1951). The analysis was supported by the existence of three basic assumptions: (1) regions are separated by a volume-dependent transportation cost attributed to a physical unit; (2) there are no legal restrictions to limit the actions of the profit seeking traders of each region; and (3) transportation costs are known, and the production and consumption functions in each region are given. The descriptive analysis would determine the net price in each region, the quantity of exports or imports for each region and the volume and direction of trade between all possible regions.

A year later, Samuelson followed with a mathematical formulation of Enke's analysis (Samuelson, 1952). The result was a maximization problem that could be considered as a standard problem in linear programming. The mathematical procedure would report the same sort of variables as in Enke's formulation but in this case obtained a by a trial and error procedure.

The prevailing procedure in the so-called spatial equilibrium models is attributed to Takashi Takayama and G.G. Judge (Takayama and Judge, 1971). These authors reformulated the Samuelson's partial-equilibrium formulation, considering the interdependencies between the different markets in production, pricing and the use of the commodity. By this mean, they established linear dependencies between regional supply, demand, and price, converting the previous specifications into a quadratic programming problem. As a further consideration, Takayama and Judge extended their spatial formulation to obtain the competitive price and product allocation when markets are separated by both space and time. As with the pure spatial equilibrium model, the concept

of net social payoff as defined by Samuelson in 1952 is used as a basis for deducing the conditions of spatial and intertemporal equilibrium.

The general specification of the spatial equilibrium model is as follows:

The demand and supply functions are respectively given by:

$$D_i = b_{oi} - b_{1i}P_i$$

$$S_j = b_{oj} + b_{1j}P_j$$

Definition of variables:

D_i = commodity demand in region i

S_j = commodity supply in region j

P_i = commodity demand price in region i

P_j = commodity supply price in region j

Q_{ij} = shipments from region i to region j

T_{ij} = transportation costs from region i and j.

Following Takayama and Judge (1971), the demand and supply equations can be expressed in their inverse form:

$$P_i = a_{1i} - a_{2i}D_i$$

$$P_j = a_{3j} + a_{4j}S_j$$

where $a_1, a_2, a_3, > 0$ and $a_4 < 0$ over all observations.

The constraints imposed on the demand and supply relations are the following:

$$D_i \leq \sum_j^n Q_{ij}$$

$$S_j \geq \sum_i^n Q_{ij}$$

Transportation costs and shipments are assumed to be non-negative:

$$T_{ij}, Q_{ij} \geq 0.$$

The objective function, called the net social payoff (NSP) is a market oriented quasi-welfare function:

$$NSP = \sum_i \int_0^P P_i(D_i) dD_i - \sum_j \int_0^P P_j(S_j) dS_j - \sum_i \sum_j Q_{ij} T_{ij}$$

Given the particularities of the world orange juice market, the model has to be modified to include the imposition of fixed per-unit tariffs and ad-valorem tariffs. While the per-unit tariff can be included in T_{ij} , representing per-unit transfer cost, ad-valorem tariffs need a more elaborated inclusion. Thus, per-unit transfer costs are given by

$$T_{ij} = t_{ij} + Tar_{ij},$$

where t_{ij} is the transportation cost and Tar_{ij} is a fixed per-unit tariff. Following Spreen's formulation, the imposition of ad-valorem tariff can be included as follows (Spreen, 2000). Assume that the ad-valorem tariff imposed by imported region j is AD_j , so that the price faced by importers in region j is

$$P_j = \tilde{P}_j (1 + AD_j)$$

where $\tilde{P}_j$ is the per unit price before the duty is paid. Rearranging terms give

$$\tilde{P} = \frac{P_j}{1 + AD_j}$$

where $\tilde{P}$ is the price faced by exporters, and it includes transportation costs from exporting regions. The impact on an ad-valorem tariff can be included in NSP as follows

$$NSP = \sum_{j=1}^J \frac{1}{1 + AD_j} \int_0^P P_i(D_i) dD_i - \sum_j \int_0^P P_j(S_j) dS_j - \sum_i \sum_j Q_{ij} T_{ij}.$$

A Mathematical Model of the World Orange Juice Market

A mathematical model of the world orange juice market has been developed at the University of Florida. The first report of this model was by McClain (1989). Since that time it has been used to make a number of assessments of trade liberalization in the world orange juice market.

The world orange juice model is a multi-year spatial equilibrium model. The supply side of the model is implicit in that a relationship between current price and quantity is not specified. Rather, orange production in Florida and Sao Paulo is based upon the orange tree inventories in those respective regions. The linkage of price and production is accomplished through a new planting function. It specifies that new plantings react to price changes. Orange trees take several years to reach full production generating a substantial lag between a price signal and increased production. Furthermore, given the high initial cost of orange grove development, there is also a substantial lag between depressed prices and contraction of production.

To mathematically specify the model let $P_j = a_j - b_j Q_j$ be the inverse demand equation in consumption region j . In the current specification, the four consumption regions considered are the United States, Canada, the European Union (EU), and Japan. In Canada, the EU, and Japan the main processed orange product consumed is frozen concentrated orange juice (FCOJ). Thus, quantity in these three markets is FCOJ. In the United States, however, not-from-concentrate (NFC) now accounts for approximately 40 percent of orange juice consumption. NFC also has been well accepted in Canada. Recent data compiled by the Florida Department of Citrus suggests that NFC now accounts for approximately 30 percent of orange juice consumption in Canada

To account for the presence of NFC, a two-equation inverse demand system is estimated for the United States and Canada. Omitting the j subscript, the linear form of this system is:

$$(1) \quad P_{FCOJ} = \alpha_1 + \beta_1 Q_{FCOJ} + \gamma_1 Q_{NFC}$$

$$(2) \quad P_{NFC} = \alpha_2 + \beta_2 Q_{NFC} + \gamma_2 Q_{FCOJ}$$

Where: P_{FCOJ} is the processor price of FCOJ,

P_{NFC} is the processor price of NFC,

Q_{FCOJ} is the quantity of FCOJ¹

Q_{NFC} is the quantity of NFC.

The parameters γ_1 and γ_2 are the “cross-price” effects, i.e. the impact of a change in the quantity of one product on the price of another product. In order to formulate the quadratic programming model, which will determine the optimal allocation of orange juice gross product forms and spatially separated markets, it must be assumed that $\gamma_1 = \gamma_2$ (for further discussion see McCarl and Spreen, 1980).

For the other consumption regions, let the inverse demand equation be given by

$$(3) \quad P_j = a_j - b_j Q_j$$

where: P_j is the price of FCOJ in region j (j = European Union or Japan),

and Q_j is the quantity of FCOJ consumed in region j .

To develop the supply side of the model, remember the existence of the lag between production decisions and output. In Florida, there are excellent data available on the number of orange trees disaggregated by variety, age, and location. In Sao Paulo,

¹ This includes that purchased as FCOJ and chilled reconstituted juice from FCOJ. The pricing in the model is done at the processor level.

Brazil, the quality of the tree data is less although the distribution of tree numbers across age categories can be estimated based upon data published by the Foreign Agricultural Service (FAS) of the USDA.

Let: n_{ia} be the number of trees in age category a in region i and i can equal Florida or Sao Paulo.

Let: Y_{ia} be the yield of oranges per tree associated with a tree of age a located in production region i .

$$\text{Then: } (4) \quad \sum_a n_{ia} Y_{ia} = TP_i$$

is the total production of oranges in region i , and TP_i denotes total fresh orange production.

In Florida, processed orange utilization is high and has remained relatively constant at 94 percent over recent years. In Sao Paulo, a larger proportion of orange production is utilized in its internal market as fresh oranges (which often are juice at home). Processed utilization in Sao Paulo ranges from 70-75 percent. In this model, assume that processed orange utilization is a fixed proportion of the crop and is given by U_i .

$$\text{Thus: } (5) \quad OJ_i = TP_i * U_i * JU_i$$

where: OJ_i is orange juice production in region i , and JU_i is a conversion factor between fresh oranges and volume of orange juice.²

The presence of two products in Florida, NFC and FCOJ, however, complicates the conversion of fresh oranges to orange juice. A separate sub-model must be developed in order to model the allocation of oranges to NFC and FCOJ.

² This term is commonly referred to as "juice yield". In Florida, it is measured as pound solids per box.

The quality of oranges used for processing can be characterized by three main factors: Brix, ratio, and color score. Brix is a measure of the orange solids content of the juice. A Brix level of 11.8° is the ideal level for single-strength juice such as NFC. On the other hand, a high Brix level is desired for oranges used for FCOJ. In the FCOJ process, water is removed to attain a level of concentration of 65° Brix.³ Ratio represents the solids/acid ratio. A high ratio is associated with very sweet juice, while low ratio juice may be sour. The desired level of ratio in the United States market is 15.5-17.5.

Color score is a concept which has its origin in the grading system used by the United States Department of Agriculture (USDA). The USDA grading system for FCOJ sold in the United States is based upon three factors: color, defects, and flavor. Most processors, marketing in the United States and the EU, achieve low levels of defects.

Flavor is related to Brix and ratio, but there are other less quantifiable factors, which also affect flavor. Color is based upon a 40-point scale in which darker juice is awarded a higher value. Juice from Valencia oranges typically is darker in color (and thus with a higher color score) compared to juice from earlier maturing varieties such as Hamlin. The Pera variety grown extensively in Brazil also produces juice of good color.

Given these observations a blending model is developed for FCOJ and NFC for the U. S. market. It assumes that each of these products can be made from the following ingredients:

- Hamlins from Florida
- Valencias from Florida
- Valencias from California
- Valencias from Mexico
- Valencias from Brazil

³ Many processors in Sao Paulo now produce 66° Brix FCOJ.

The quality requirements are minimum and maximum Brix for NFC, minimum color score for both FCOJ and NFC, and minimum and maximum ratio for FCOJ and NFC. Estimates of average Brix, ratio, and color score for each of the ingredients were provided by industry sources.

To mathematically formulate the blending model,

Let: Z_{ivp} be gallons of orange juice of product type p , produced in region i , made from variety v ,

and $i = \text{Florida, California, Mexico or Brazil}$

$v = \text{Hamlin or Valencia, and}$

$p = \text{FCOJ or NFC.}$

Next define:

a_{ivpc} as the level of quality attribute c per unit of Z_{ivp} ,

and $c = \text{Brix, ratio or color}$

The desired level of quality attribute c is achieved by imposed set of constraints of the form

$$(6) \quad \sum_v a_{ivpc} Z_{ivp} \leq QU_{ipc}$$

$$(7) \quad \sum_v a_{ivpc} Z_{ivp} \geq QL_{ipc}$$

where: QU_{ipc} is the upper limit imposed on quality attribute c in product p produced in region i and,

QL_{ipc} is the lower limit imposed on quality attribute c in product p produced in region i .

To complete the model, two more issues must be considered. First consider the tariffs imposed on imported orange juice. The United States applies a per unit tariff on imports from Brazil. In the framework of a spatial equilibrium model, per unit tariffs are added to transportation costs so that the transfer cost from region i to region j is

$$T_{ij} = t_{ij} + tar_j$$

where t_{ij} is the per unit transportation cost and tar_j is the tariff imposed by region j . The European Union and Japan, however, use ad-valorem tariffs. Ad-valorem tariffs are percentage tariffs. In a standard spatial equilibrium model, integrating the demand function and summing across regions forms the objective function. To simplify the exposition, if all demand equations are of the form

$$P_j = a_j - b_j Q_j,$$

and there are J demand regions, then the objective function looks like

$$\sum_{j=1}^J \int_0^{Q_j} (a_j - b_j Q_j) dQ_j \quad \text{or} \quad \sum_{j=1}^J (a_j Q_j - \frac{1}{2} b_j Q_j^2)$$

The ad-valorem tariff is imposed by dividing the integral by one plus the tariff expressed as a decimal, or

$$(8) \quad \sum_{j=1}^J \frac{1}{1+AD_j} (a_j Q_j - \frac{1}{2} b_j Q_j^2)$$

The other issue relates to new plantings. Based upon previous work of McClain (1989) and Kalaitzandonakes and Shonkwiler (1992), the specification that provides the best prediction of new plantings is that new plantings react to current and lagged on-tree prices i.e.

$$NP_{t+1} = f(ON_t, ON_{t-1}, \dots, ON_{t-k})$$

where: NP_t is new plantings in t

ON_t is the on-tree (or grower) price in year t

k is the number of years in the lag structure

Previous work indicates that in Florida, a three-year moving average of on-tree prices is the best predictor of new plantings adjusted for lagged inventory. This equation is of the form

$$(9) \quad NP_{t+1}^F = \frac{\eta_F (ON_t^F + ON_{t-1}^F + ON_{t-2}^F)}{3} + \theta_F INV_t^F$$

where the superscript F denotes Florida, INV_t^F is the lagged total tree inventory in Florida, $\eta_F > 0$ and $\theta_F < 0$ are parameters. The presence of a negative effect from lagged inventory can best be explained by the constraints facing growers in Florida due to increasing urbanization, competition for land and water, and increasing environmental regulation.

In Sao Paulo, citrus must compete with sugarcane for land and capital. The new planting equation for Sao Paulo takes the form

$$(10) \quad NP_{t+1}^{SP} = \eta_{SP} + \theta_{SP} \left[\frac{ON_t^{SP}}{SC_t} \right]$$

where the superscript SP refers to Sao Paulo and SC_t is the price of sugarcane paid to growers in year t .

To write the complete model, note that it has two main components: the production model for Sao Paulo and Florida and the pricing model. The production model for year t uses the price equilibrium from year $t - 1$ to compute on-tree prices in Sao Paulo and Florida. These prices are used in equations (9) and (10) to predict new plantings in each region. Trees of age $a - 1$ in year $t - 1$ are moved to age a in year t , adjusted for death loss, i.e.

$$(11) \quad n_{ia,t} = n_{i,a-1,t-1} * (1 - DL_{i,a-1})$$

where $DL_{i,a-1}$ is the death loss associated with trees of age $a - 1$ in region i .

Once the new tree age distribution is known, equations (4) and (5) are used to project orange juice production in both regions. After $OJ_{iv,t}$ is calculated, it is used as input into the spatial equilibrium model. Omitting the time subscript for simplicity, the spatial model is

$$\begin{aligned}
& \max \sum_{j=EU,JAPAN} \frac{1}{1+AD_j} \left(a_j Q_j - \frac{1}{2} b_j Q_j^2 \right) \\
& + \sum_{j=US,CAN} \int (\alpha_{1,j} - \beta_1 Q_{j,FCOJ} + \gamma_{1,j} Q_{j,FCOJ}) dQ_{j,FCOJ} \\
& + \int (\alpha_{2,j} - \beta_2 Q_{j,NFC} + \gamma_{2,j} Q_{j,NFC}) dQ_{j,NFC} \\
& - \sum_i \sum_j \sum_p T_{ijp} X_{ijp} \\
& s.t. \quad - \sum_i X_{ijp} + Q_{jp} \leq 0 \\
& \quad - Y_{ip} + \sum_j X_{ijp} \leq 0 \\
& \quad - \sum_v Z_{ivp} + Y_{ip} \leq 0 \\
& \quad \sum_p Z_{ivp} \leq OJ_{iv} \\
& \quad \sum_v a_{ivpc} Z_{ivp} \leq QU_{ipc} \\
& \quad \sum_v a_{ivpc} Z_{ivp} \geq QL_{ipc}
\end{aligned}$$

all variables are non-negative, and X_{ijp} , Q_{jp} , OJ_{iv} , and Z_{ivp} are defined as before. Y_{ip} is the quantity product p produced in supply region i .

In this formulation, it is assumed that the blending occurs in the supply region and then is shipped to the consumption market. Since, at the present, the United States is the

only market in which the model allows the consumption of both NFC and FCOJ, this assumption imposes no limitation. If, however, the model is expanded to allow NFC consumption in other markets, it may be necessary to reconfigure the model so that blending occurs in the consumption region.

The two sub-models: production and spatial pricing are solved in a forward recursive fashion over a specified time horizon. A program written in GAMS is used to solve the combined models on a desktop personal computer.

Empirical Results

The results from the model can be seen in Table 4.3. The second column of the table shows forecasted orange production of Florida through the 2010-11 season. As can be seen from these results, production of oranges in Florida will continue its expansion through the years supported by an increasing on-tree price (column 3). At the same time, the FOB price for FCOJ in Florida is projected to increase at an average rate of 1.2 percent. This percentage represents an incentive for the exports of orange juice from Mexico besides some other economic factors. Mexican exports are also shown in Table 4.3. These results are obtained assuming that orange juice production in Mexico remains constant at 50 million SSE gallons or 51.45 million pound solids.

Over the period extending from 2002 through 2006, the model suggests that Mexico will fail to fill the 41.16 million pound solid (equivalent to 40 million SSE gallons) tariff rate quota. Instead, the model chooses to send orange juice to Canada, which presently imposes no tariff barriers on orange juice imports from its NAFTA partners. Beginning in the 2006-7 season, however, exports from Mexico to the U.S. market increase significantly. By this season, the tariff-rate quota has disappeared and the

tariff rate is less than six cents per pound solid. The cost of shipping to the United States plus the tariff is now less than the cost of shipping to Canada.

Table 4.3. Projected Florida orange production, on-tree price and FCOJ prices, 2002-3 to 2010-11 season

Season	Florida production (million boxes)	Florida on-tree price (dollars/box)	FOB FCOJ in Florida (dollars/pound solid)	Mexican exports (million pound solids)	Increased Mexican exports (million pound solids)
2002-3	251.248	4.392	1.045	21.06	21.06
2003-4	253.208	4.520	1.063	14.78	14.78
2004-5	254.708	4.622	1.078	17.87	21.16
2005-6	255.988	4.709	1.090	20.62	30.34
2006-7	257.729	4.763	1.097	51.45	66.45
2007-8	259.875	4.800	1.101	51.45	71.45
2008-9	262.148	4.818	1.101	51.45	76.45
2009-10	264.609	4.797	1.096	51.45	81.45
2010-11	266.396	4.869	1.109	51.45	86.45

A scenario was defined under which it is assumed that beginning in 2004-5, Mexico's orange juice production will start on an upward trend, increasing at the rate of 5 million pound solids per year. The results of this scenario are shown in the fifth column of Table 4.3. It can be seen that additional orange juice production is shipped to the United States as FCOJ. With these increased shipments, on-tree prices and FOB FCOJ and NFC prices in Florida decline modestly. On-tree prices in 2010-11 in Florida are projected to be \$4.93 per box under flat Mexican exports and \$4.87 per box with increased Mexican exports (Table 4.4). Mexico also tends to displace Brazil as the import supplier to the U.S. market.

Despite its proximity to the United States, the model chooses to allocate all of Mexico's orange juice production to FCOJ as opposed to NFC once tariffs are removed. This result is somewhat surprising as the main disadvantage facing Brazil in the U.S.

market has been the growth of NFC consumption. NFC is much more costly to ship long distances as the transportation cost per unit of single-strength consumption is six times higher for NFC compared to FCOJ.

Table 4.4. Florida on-tree and FOB prices for FCOJ and NFC, 2002-3 to 2010-11

Season	Flat Mexican exports			Increased Mexican exports		
	On-tree (dollars /box)	FOB FCOJ (dollars/pound solid)	FOB NFC (dollars/pound solid)	On-tree (dollars/ box)	FOB FCOJ (dollars/pound solid)	FOB NFC (dollars/pound solid)
2002-3	4.39	1.045	1.451	4.39	1.045	1.451
2003-4	4.52	1.063	1.461	4.52	1.063	1.461
2004-5	4.78	1.082	1.477	4.62	1.078	1.468
2005-6	4.82	1.093	1.495	4.71	1.090	1.478
2006-7	4.84	1.101	1.512	4.76	1.097	1.488
2007-8	4.87	1.105	1.529	4.80	1.101	1.497
2008-9	4.91	1.104	1.548	4.82	1.101	1.508
2009-10	4.81	1.098	1.565	4.80	1.096	1.519
2010-11	4.93	1.103	1.574	4.87	1.109	1.538

Concluding Remarks

NAFTA linked the economies of the United States, Mexico, and Canada. During the NAFTA negotiations, the debate regarding orange juice was spirited. Eventually a side agreement was reached that resulted in a 15-year phase-out period of both the U.S. and Mexican orange juice tariff. The tariff phase-out schedule was formulated in a manner such that most of the reduction will occur over the last five years, i.e., from 2003-2008.

It has been more than nine years since NAFTA was implemented. During these years, Mexico's citrus industry has endured a difficult period marked by drought and diminished exports of orange juice to the United States as production in Florida recovered from the devastating freezes of the 1980s. As such, to date, NAFTA has had little, if any effect on the U.S. orange juice market and has failed to stimulate expanded

processed orange production in Mexico. In fact, processed orange utilization in Mexico as a percentage of total utilization declined over the 1990s (Figure 4.2).

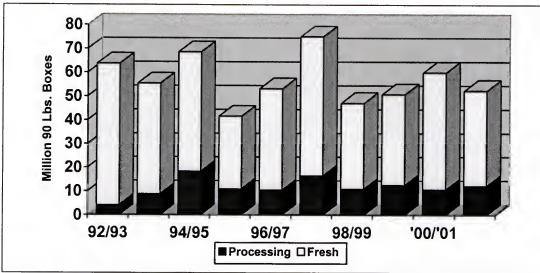


Figure 4.2. Mexico. Oranges for fresh consumption VS processing, 92/93-'01/'02

In this chapter, a scenario was analyzed in which it was assumed that beginning in 2004-5, Mexican orange juice production would call for expanded processed orange production at the rate of five million pound solids per year in response to lower tariffs. With this rate of increase, orange juice production would increase to 86 million pound solids compared to 51.45 million pound solids in the baseline model. This level of increased production would have a small negative effect on Florida grower prices, decreasing on-tree prices by \$.20 per box or approximately four percent.

Additional research is needed to better understand the allocation process in Mexico between fresh and processed utilization. It is also necessary to better understand supply response in Mexico as the tariff is eliminated and returns to processed utilization improve. The citrus industry in Mexico is still dominated by small growers with limited access to technology. It is also plagued by poor coordination between growers and processors (Mondragon, et al., 1998). This highly fragmented industry may find it

difficult to compete with Florida and Brazil despite the advantages it possesses in terms of lower labor costs and geographical proximity to the U.S. market.

CHAPTER 5

SUMMARY AND CONCLUSIONS

The case of the Mexican citrus industry presents an opportunity to analyze the complexity and diversity of agriculture in Mexico, under a framework of integration and trade liberalization. The new challenges that this new form of economic structure is imposing on the industry are not only its performance but also to a better and more complete understanding of the elements involved. During the last five years, there has been scant research published on the citrus industry in Mexico, in particular the processing sector. The analysis presented here does not offer specific solutions to the problematic situation that the Mexican citrus industry is confronting. Instead, this analysis presents a framework for further analysis and discussion.

The circumstances under which Mexico is entering the new century should be carefully considered. The series of political, social and economic transformations accomplished during the 1990's were a consequence of a determined position of the government to place Mexico into a new era of competition. In this, desperate attempt, the country has signed more trade agreements than any other country in the world. Although results are still not visible, the existence of these agreements represents a compromise for Mexico in terms of economic sovereignty. For instance, 2003 represents a major change for agriculture in the context of NAFTA. A new phase of tariff reductions on farm produce began on January 1st. Agricultural and political organizations in Mexico have organized and started to seek protection by the government. Some groups have even

taken this movement to the extreme of requesting to the government a renegotiation of the agreement.

The presence of NAFTA in the Mexican economy has represented an opportunity and a reorientation of trade. As shown in this analysis, exports from Mexico to Canada and the U.S. have significantly increased since 1994 and its importance as a trading partner for those countries has increased since then. The type of products representing this new position is mainly manufacturing.¹ In 1982 manufacturing represented 26 percent of total Mexican exports and oil and mining products 68 percent. In 2001, manufacturing represented 89 percent while oil and mining only 8 percent. Agriculture, however, decreased from 6 percent in 1982 to 3 percent in 2001. The lesser dependency on oil related products has been convenient for a country that heavily relied on oil exports during the 1980's. Diminishing participation in agricultural exports, however, represents a major concern for a country in which most of its social problems and inequalities are located in the rural sector.

The so-called *reforma agraria* has not yet proved to be effective, and land tenure is still an aspect that needs greater government involvement. This recommendation does not imply the reinstallation of the government as a paternalist figure of subsidiary policies. Instead, its presence is required to ensure that reform is implemented, and the ejido develops an active role in agricultural production. A vast majority of farmers in Mexico are dealing with overdue credits and high interest rates. Orange production is not the

¹ The number of *maquiladoras* established in the Mexican territory has almost triplicated since 1994, and currently a network of more than 3,500 is supporting the export capacity of the country. Maquiladoras, however, are not well seen in Mexico because they represent low salaries and are not considered "Mexicans" For additional information about Maquiladooras consult El Colegio de la Frontera Norte. <http://www.colef.mx>

exception, rather is the rule. Many orange orchards are currently abandoned and no large-scale investment is being made at any of them.

Decreasing participation of the Mexican orange juice processing industry in the U.S. market is partially explained by the present condition of agriculture in Mexico. As mentioned in this research, orange consumption in Mexico is mainly fresh fruit. When the supply of oranges is scarce, the fresh market imposes prices that the processing sector cannot afford, unless this situation is accompanied by the presence of high international FCOJ prices. The fresh market is a primary target for producers and coyotes, converting the processing industry in a residual recipient of production. Lack of coordination with orange production, mainly restricted by land fragmentation, exposes the industry to a seasonal unpredictable level of production, precluding the ability of signing long-term agreements with U.S. costumers.

In an attempt to reduce this uncertainty with respect to the fresh market, the processing industry in Mexico has opted to vertically backward integrate into orange production. This integration, though, is characterized by two particularities. First, the industry did not purchase existing orange orchards or use long-term contracts with orange farmers. Instead, the industry started to develop its own orchards, experimenting with new orange varieties and tree density. Although this process may be beneficial for the industry, it is extremely costly in terms of resources and time. Secondly, this integration tends to be absolute. The analysis presented herein, with the assistance of Coasian theory suggests that this degree of integration is usually not recommended. No evidence exists that the processing industry, in general, utilized economic criteria to determine its level of

integration. When questioned by the author at this respect, managers responded that the process was guided by their orange processing capacity at the plant.

There is no doubt, however, that the integration process followed by the processing industry, represents a new modality of production, inserted in a framework of structural changes that have occurred during the last ten years in Mexico. Besides, this new modality of production and organization undertaken by surviving processing plants, indicates a considerable level of knowledge about marketing.

One of the main limitations of this analysis is the lack of empirical analysis in terms of the degree of integration by part of the processing industry in Mexico. Application of the Coasian theory requires detailed information about production costs, and this information, if it exists, is not accessible. Current information on the processing sector in Mexico is a major constraint when analyzing the industry.

Another aspect explaining the meager performance of the processing industry in the context of NAFTA might be found in the agreement itself. As discussed in this research, the U.S. tariff rate quota schedule for Mexican imports of orange juice is highly restricted. The tariff has been restricted, allowing recovery of the industry in the U.S., particularly in Florida. The spatial equilibrium model implemented to forecast the situation of the Mexican industry in the near future has shown positive results once the tariff is eliminated. This fact indicates the tariff is an element preventing an improving participation of the Mexican industry into the U.S. market.

It should be considered, however, the model assumes predetermined levels of orange juice production. To reach these levels of exports, the industry in Mexico must attain this production. A more interesting exercise would have been to include in the

model an endogenous supply function for the processing industry in Mexico. Again, systematic and reliable data about the citrus industry in Mexico were not found. A major task for the citrus industry in Mexico is to develop a data system. This will lead the industry to facilitate analysis and diagnosis that enhance its performance. One of the projects the newly formed national citrus organization has in mind is the creation of a citrus census, which will make transparent the current status of the industry. This mission seems complicated in a scheme of low participation.

It is necessary to mention that the citrus industry in Mexico is in need of being analyzed more carefully and in a broader scope. The presence of Mexico in markets such as the European Union and Latin America should be also evaluated. These markets represent an alternative for the industry and their potential level of trade with the citrus industry in Mexico should be explored. Products such as NFC can be a feasible alternative for the industry not just in these markets but also in the U.S.

Finally, there is a market to be developed in terms of processed juices in Mexico. Some processing plants in Martinez de la Torre are selling FCOJ at the retail level. A one-liter bottle costs the equivalent of two U.S. dollars in pesos. Although not distributed by a market chain, the product is still consumed. During the author's visit to processing plants in Mexico, several bottles were bought, reconstituted and distributed among friends and family members. None of them were disliked by its consistency or flavor. The value added to oranges by processing plants could be beneficial for farmers, processors and consumers in Mexico.

APPENDIX ONE-YEAR EXAMPLE OF THE GAMS MODEL

The following model is an example of the World Orange Juice Market Model utilized in this dissertation. The model updates through the years, considering the tariff elimination scheduled in NAFTA.

The first simulation is for the 1999-00 crop year. The 1996 tariff
* schedules are used.

SETS

AGEF	age classes for florida	/1 * 25/
AGEB	age classes for brazil	/1 * 21/
I	supply regions	/BRAZIL, US, MEXICO/
J	markets	/USA, CAN, EU, JAPAN/
P	Products	/FCOJ,NFC/
V	fruit variety	/EA-MID, VAL, TEMPLE/
ATTRIB	juice attributes	/COLOR, RATIO, BRIX/
YEAR	report years	/1999-0, 2000-1, 2001-2, 2002-3, 2003-4, 2004-5, 2005-6, 2006-7, 2007-8, 2008-9, 2009-10 2010-11, 2011-12, 2012-13 2013-14, 2014-15, 2015-16, 2016-17, 2017-18,2018-19, 2019-20 /
LST1	list of items in rpt one	/PROD, ON-TREE, OJ-PROD, FOB-OJ, FOB-NFC/
LST2	list of items in rpt two	/NEWPL, NON-BEAR, BEARING, TOT-TREE, ACRES/
LST3	list of items on consum report	/QUANTITY, PRICE/
LST4	list of items on FL juice report;	

*Juice characteristics

TABLE MINQUAL(ATTRIB,J,P) Min product quality

	FCOJ	NFC
COLOR.USA	34.5	35.7
RATIO.USA	15.5	14.0
BRIX.USA	11.0	11.0
COLOR.CAN	33.5	36.5
RATIO.CAN	12.5	14.0
BRIX.CAN	11.0	11.0
COLOR.EU	33.5	
RATIO.EU	12.5	
BRIX.EU	11.0	
COLOR.JAPAN	33.5	
RATIO.JAPAN	12.5	
BRIX.JAPAN	11.0	

TABLE MAXQUAL(ATTRIB,J,P) Max Attributes of each juice

	FCOJ	NFC
COLOR.USA	60	60
RATIO.USA	19.5	19.5
BRIX.USA	15.0	13.0
COLOR.CAN	60	60
RATIO.CAN	19.5	19.5
BRIX.CAN	13.0	13.0
COLOR.EU	60	
RATIO.EU	19.5	
BRIX.EU	13.0	
COLOR.JAPAN	60	
RATIO.JAPAN	19.5	
BRIX.JAPAN	13.0	

TABLE INPUT(V, I, ATTRIB) Attributes of each juice

	COLOR	RATIO	BRIX
VAL.BRAZIL	36.7	16.0	12.0
VAL.US	36.7	16.2	12.5
VAL.MEXICO	37.5	15.0	12.0
EA-MID.BRAZIL	33.5	12.6	10.0
EA-MID.US	34.6	14.9	12.0
TEMPLE.US	35.0	11.9	12.0;

* Florida Data

TABLE FTREE(AGEF, V) tree inventory for Florida trees in millions of trees

	EA-MID	VAL	TEMPLE
1	1.3424	1.5872	.0115
2	0.8617	1.8782	.0239

3	0.9244	1.8852	.0138
4	.7271	1.1533	.0116
5	1.1062	1.3096	.0267
6	0.8260	1.1260	.0298
7	1.7906	2.2929	.0195
8	2.9964	3.6688	.0199
9	3.7783	4.1654	.0179
10	2.6142	3.9547	.0097
11	3.4140	4.0464	.0354
12	2.4624	2.5315	.0188
13	3.4944	3.0772	.0176
14	2.0807	1.6865	.0199
15	1.0865	.8196	.0022
16	.9805	.6619	.0063
17	1.6153	.9316	.0097
18	.8723	.5281	.0041
19	.8327	.4701	.0072
20	.4480	.3797	.0025
21	.4364	.3790	.0029
22	.2541	.2416	.0017
23	.2534	.2126	.0016
24	.2069	.2166	.0009
25	6.5492	6.0423	.3836 ;

TABLE FYLD(AGEF,V) dist of yield by age for Fla boxes per tree

	EA-MID	VAL	TEMPLE
1			
2			
3			
4	.880	.810	.70
5	1.460	1.230	.88
6	2.020	1.650	1.06
7	2.580	1.990	1.178
8	3.100	2.220	1.298
9	3.360	2.470	1.41
10	3.620	2.560	1.528
11	3.880	2.650	1.648
12	4.050	2.740	1.76
13	4.100	2.986	1.918
14	4.150	3.110	2.076
15	4.200	3.200	2.230
16	4.250	3.290	2.388
17	4.300	3.380	2.546
18	4.350	3.460	2.700
19	4.400	3.540	2.968

20	4.480	3.630	3.238
21	4.600	3.710	3.502
22	4.720	3.790	3.772
23	4.840	3.870	4.040
24	4.960	3.925	4.304
25	5.000	3.980	4.580 ;

TABLE FACRE(AGEF,V) Florida orange tree acres by variety and age

	EA-MID	VAL	TEMPLE
1	10193	11872	104
2	6418	13912	130
3	6907	14012	101
4	5263	7646	94
5	8168	9059	141
6	5842	7502	123
7	12572	15802	156
8	21930	25122	161
9	27063	27846	160
10	18750	25744	81
11	23250	26982	293
12	18044	17982	158
13	26617	22602	153
14	15953	12347	156
15	8741	5998	20
16	8128	5340	54
17	13593	7554	83
18	7447	4338	38
19	7097	3854	67
20	3861	3064	24
21	3801	3099	33
22	2241	2119	17
23	2252	1846	16
24	1839	1786	10
25	64186	57864	3719;

PARAMETER ACREYLD(V) per acre production for trees over ten years of age
 * in millions of boxes per acre

/ EA-MID .000525

VAL .000375

TEMPLE .000450/ ;

PARAMETER SURVF(AGEF) Survival rates for Fla trees

/ 1 1.0

2 1.0

3 * 5 .99
 6 * 8 .985
 9 * 13 .98
 14 * 23 .97
 24 * 25 .945/;

PARAMETER SURVAC(AGEF) Survival rates for Fla acre

/ 1 1.0
 2 1.0
 3 * 5 1.0
 6 * 8 .99
 9 * 13 .985
 14 * 23 .975
 24 * 25 .955 /;

PARAMETER FNEW new plantings in florida;
 FNEW = SUM(V, FTREE('1',V));
 PARAMETER FTOTTR total trees in florida;
 FTOTTR = SUM((AGEF,V), FTREE(AGEF,V));
 PARAMETER FBEAR bearing trees in florida;
 FBEAR = SUM((AGEF,V), FTREE(AGEF,V)\$ (ORD(AGEF) GT 3));
 PARAMETER FNON nonbearing trees in florida;
 FNON = FTOTTR - FBEAR;
 PARAMETER FTOTACR total bearing acres;
 FTOTACR = SUM((AGEF,V), FARE(AGEF,V)\$ (ORD(AGEF) GT 3));
 PARAMETER FUTIL(V) /EA-MID .93, VAL .96, TEMPLE .66/;

PARAMETER FTP(V) Orange production by variety (million boxes)
 /EA-MID 134 , VAL 99, TEMPLE 1.95/;
 PARAMETER FLORG total florida orange production;
 FLORG = SUM(V, FTP(V));

PARAMETER FJUCYLD(V) Juice yield by variety in lbs of solids per box
 /EA-MID 6.25, VAL 7.04, TEMPLE 6.41/;

PARAMETER JUC(V) Juice of each variety;
 JUC(V) = FTP(V)*FUTIL(V)*FJUCYLD(V);
 JUC('EA-MID') = 781.9;
 JUC('VAL') = 664.4;
 JUC('TEMPLE') = 9.66;
 PARAMETER FJUC total juice produced from Florida trees (million lbs solids);
 FJUC = SUM(V, JUC(V));
 FJUC = 1456;
 PARAMETER FLUTIL total processed utilization in florida;
 FLUTIL = SUM(V, FTP(V)*FUTIL(V));

*Assume juice production in other US states is 68.23 mil pounds solids

PARAMETER USOJ(V) Total OJ produced in the US;

USOJ("EA-MID") = JUC("EA-MID");

USOJ("VAL") = JUC("VAL")+68.23;

USOJ("TEMPLE") = JUC("TEMPLE");

SCALAR MEXCROP Mexican orange crop in million boxes /75/;

PARAMETER CMEX(V) intercept vector for Mexican supply equation;

CMEX("VAL") = 1;

DISPLAY CMEX;

* Brazil Data

PARAMETER BTREE(AGEB) tree inventory for Brazil in the 99-00 season

/1 4, 2 4, 3 4, 4 7, 5 9, 6 10, 7 13, 8 15, 9 10,

10 11, 11 11, 12 8, 13 8, 14 8, 15 9, 16 9, 17 8, 18 8, 19 8, 20

6, 21 4/;

PARAMETER BYLD(AGEB) yield distribution for Brazilian trees

/1 0, 2 0, 3 0, 4 0.6, 5 1.1, 6 1.5, 7 1.8, 8 2.0, 9 2.2, 10

2.4, 11 2.6, 12 2.8, 13 2.8, 14 2.6, 15 2.6, 16 2.5, 17 2.5, 18 2.4, 19

2.2, 20 2.1, 21 2.0/;

PARAMETER SURVB(AGEB) survival rate for brazil tree

/1*3 1, 4*6 .99, 7*9 .98, 10 .98, 11 .97, 12 .95, 13 .945,

14 .94, 15*17 .93, 18*19 .90, 20*21 .85/;

PARAMETER BNEW New plantings in brazil;

BNEW = BTREE('1');

PARAMETER BTOTTR total trees in brazil;

BTOTTR = SUM(AGEB, BTREE(AGEB));

PARAMETER BRBEAR bearing trees in brazil;

BRBEAR = SUM(AGEB, BTREE(AGEB)\$ (ORD(AGEB) GT 3));

PARAMETER BRNON nonbearing trees in brazil;

BRNON = BTOTTR - BRBEAR;

DISPLAY BTOTTR, BRBEAR, BRNON;

SCALAR BJUCYLD Juice yield in brazil /6.00/

BTP Orange production in Sao Paulo / 395/;

PARAMETER BUTIL(V) Distribution of juice for processing

/VAL 0.74/;

PARAMETER BJUC total val juice from Brazil in lbs solids;

BJUC(V) = BTP*BUTIL(V) *BJUCYLD;

BJUC('VAL') = 1755;

PARAMETER SUPPLY(I,V) total supply of each variety;

SUPPLY("BRAZIL", V) = BJUC(V);

SUPPLY("US", V) = USOJ(V);

*Baselining for 1999-2000

PARAMETER TOTSUPP Total supply of juice;

TOTSUPP = SUM ((I,V), SUPPLY(I,V)); DISPLAY TOTSUPP;

TABLE BASEQUANT(P,J) Baseline quantities

	USA	CAN	EU	JAPAN
FCOJ	1070	87.1	1373	140
NFC	530	42.9		

*Calculating proportions allocated by market;

PARAMETER TOTJC;

TOTJC = SUM((P,J), BASEQUANT(P,J)); DISPLAY TOTJC;

PARAMETER PROPN(P,J);

PROPON(P,J) = BASEQUANT(P,J)/TOTJC; DISPLAY PROPON;

*Computing baseline for juice consumption

PARAMETER BASECONS(P,J);

BASECONS(P,J) = PROPON(P,J)*TOTSUPP; DISPLAY BASECONS;

TABLE ELAS(J,P) Elasticity in market j for product p

	FCOJ	NFC
USA	.6	1.0
CAN	.6	1.0
EU	.9555	
JAPAN	.92	

TABLE PRICES(J,P) Observed prices

	FCOJ	NFC
USA	0.93	1.45
CAN	0.83	1.46
EU	0.78	
JAPAN	0.94	

PARAMETER B(J,P) Computing slopes;

B(J,'FCOJ') \$ (ORD(J) GT 2) = -

PRICES(J,'FCOJ')/BASECONS('FCOJ',J)/ELAS(J,'FCOJ');

B('USA','FCOJ') = -.0036;

B('USA','NFC') = -.0020;

B('CAN','FCOJ') = -.0238;

B('CAN','NFC') = -.0440;

PARAMETER CROSS(J) cross price effect in market j;

CROSS('USA') = -.0011;

CROSS('CAN') = -.0133;

PARAMETER A(J,P) Computing intercepts;

A(J,P) \$ (B(J,P) NE 0) = PRICES(J,P) - B(J,P)*BASECONS(P,J);

A('USA','FCOJ')= PRICES('USA','FCOJ') -

B('USA','FCOJ')*BASECONS('FCOJ','USA')

- CROSS('USA')*BASECONS('NFC','USA');

A('USA','NFC')= PRICES('USA','NFC') - B('USA','NFC')*BASECONS('NFC','USA')

- CROSS('USA')*BASECONS('FCOJ','USA');

A('CAN','FCOJ')= PRICES('CAN','FCOJ') -

B('CAN','FCOJ')*BASECONS('FCOJ','CAN')

- CROSS('CAN')*BASECONS('NFC','CAN');

A('CAN','NFC')= PRICES('CAN','NFC') - B('CAN','NFC')*BASECONS('NFC','CAN')

- CROSS('CAN')*BASECONS('FCOJ','CAN');

DISPLAY B,A;

PARAMETER FONTRL(V) lagged on-tree prices in florida

/ EA-MID 4.12

VAL 5.32

TEMPLE 4.00 /;

TABLE TR(I,P,J) Transportation costs in dollars per lb of solids

USA EU CAN JAPAN

US.FCOJ 0 .16 .04 .28

BRAZIL.FCOJ .08 .09 .12 .18

MEXICO.FCOJ .07 1 1 1

US.NFC .0 .50 .20 1.00

BRAZIL.NFC .54 .54 .60 .90

MEXICO.NFC .30 1.60 .35 2.00 ;

SCALARS EUTAR Ad valorem tariff in Europe /1.152/

JPTAR Ad valorem tariff in Japan /1.255/

CATAR ad val tariff in canada /1.0/

FLTAX fdoc tax in dollars per pound solid /.031/

FLPICK Pick & haul in florida per box /1.95/

FLPROC proc cost in fla dol per lb solid /.20/

NFCBAL balance coeff in us /.50/

BZPICK Pick & haul in brazil per box /.90/

PBS price of brazilian sugar /100/

BZPROC proc costs in brazil dol per lb /.16/

BZINLAN inland trans cost in brazil dol per lb /.041/;

PARAMETER USTAR(P) us tariff for fcoj and nfc
FCOJ .2887
NFC .1652 /;

TABLE GR(J,P) Growth rates in each market		
	FCOJ	NFC
USA	.01	.03
CAN	.005	.015
EU	.02	
JAPAN	.025	;

PARAMETER TAR(J) accounting for tariffs in the objective function;
TAR('USA') = 1;
TAR('CAN') = 1/CATAR;
TAR('EU') = 1/EUTAR;
TAR('JAPAN') = 1/JPTAR;

```
PARAMETER TR1(I,P,J)  adjust brazil-us trans cost for us tariff;
TR1(I,P,J)=TR(I,P,J)+USTAR(P)*(ORD(I) EQ 1 AND ORD(J) EQ 1);
DISPLAY TR1;
```

VARIABLES

Q(J,P)	Juice Sales by market
Y(I,V,J,P)	Individual juices used to blend product
X(I,V,J,P)	Shipments from supply region to demand region
MEXSUP(V)	Supply of Mexican orange juice
CHAR(ATTRIB,J,P)	Total attributes
Z	Value of objective function

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POSITIVE VARIABLES Q,Y,X,MEXSUP,CHAR;

EQUATIONS

CS	Objective Function
MEXBAL(V)	balances mexican oj production with supply avail
SUPP(I,V)	Imposes supply balance
BAL(I,V,J,P)	Balancing at blending point
DEMBAL(J,P)	Imposes demand balances at each market
CHARAC(ATTRIB,P,J)	Total attributes
MIN(ATTRIB,J,P)	Min attributes in product
MAX(ATTRIB,J,P)	Max attributes in product;

CONTEXT

NONNEG1	Non negativity constraint
NONNEG2	Same as above ;

SOFFTEXT

CS.. Z =E= A('USA','FCOJ')*Q('USA','FCOJ') +
 0.5*B('USA','FCOJ')*SQR(Q('USA','FCOJ'))
 +A('USA','NFC')*Q('USA','NFC') + 0.5*B('USA','NFC')*SQR(Q('USA','NFC'))+
 CROSS('USA')* Q('USA','FCOJ')*Q('USA','NFC')+
 A('CAN','FCOJ')*Q('CAN','FCOJ') +
 0.5*B('CAN','FCOJ')*SQR(Q('CAN','FCOJ'))
 +A('CAN','NFC')*Q('CAN','NFC') + 0.5*B('CAN','NFC')*SQR(Q('CAN','NFC'))+
 CROSS('CAN')* Q('CAN','FCOJ')*Q('CAN','NFC')+
 (1./EUTAR)*(A('EU','FCOJ')*Q('EU','FCOJ') +
 0.5*B('EU','FCOJ')*SQR(Q('EU','FCOJ')))+
 (1./JPTAR)*(A('JAPAN','FCOJ')*Q('JAPAN','FCOJ') +
 0.5*B('JAPAN','FCOJ')*SQR(Q('JAPAN','FCOJ')))
 -SUM(V,CMEX(V)*MEXSUP(V)) - SUM(V,0.5*.066*SQR(MEXSUP(V)))
 -SUM((I,V,J,P),X(I,V,J,P)*TR1(I,P,J))- .50*Q('USA','NFC')-.30*Q('CAN','NFC');

MEXBAL(V).. MEXSUP(V) =E= SUPPLY('MEXICO',V);
 SUPP(I,V).. SUM((J,P),X(I,V,J,P)) =L= SUPPLY(I,V);
 BAL(I,V,J,P).. Y(I,V,J,P) =L= X(I,V,J,P);
 DEMBAL(J,P).. SUM((I,V),Y(I,V,J,P)) =G= Q(J,P);
 CHARAC(ATTRIB,P,J).. CHAR(ATTRIB,J,P) =E=
 SUM ((V,I), INPUT (V,I,ATTRIB) * Y(I,V,J,P));
 MIN(ATTRIB,J,P).. MINQUAL(ATTRIB,J,P)*Q(J,P) =L=CHAR(ATTRIB,J,P);
 MAX(ATTRIB,J,P).. MAXQUAL(ATTRIB,J,P)*Q(J,P) =G=CHAR(ATTRIB,J,P);

MODEL ORANGE /ALL/;
 SOLVE ORANGE USING NLP MAXIMIZING Z;

PARAMETER PR(J,P) Equilibrium juice prices;
 PR(J,P)\$ (Q.L(J,P) NE 0) = A(J,P) + B(J,P)*Q.L(J,P);

PARAMETER PR1(J,P) adjusting for cross price effects in US and canada;
 PR1(J,'FCOJ') \$ (ORD(J) LE
 2)=A(J,'FCOJ')+B(J,'FCOJ')*Q.L(J,'FCOJ')+CROSS(J)*Q.L(J,'NFC');
 PR1(J,'NFC') \$ (ORD(J) LE
 2)=A(J,'NFC')+B(J,'NFC')*Q.L(J,'NFC')+CROSS(J)*Q.L(J,'FCOJ');
 PR(J,'FCOJ') \$ (ORD(J) LE 2) = PR1(J,'FCOJ');
 PR(J,'NFC') \$ (ORD(J) LE 2) = PR1(J,'NFC');
 DISPLAY PR;
 PARAMETER FINAL(ATTRIB,J,P) Attributes for each product;
 FINAL(ATTRIB,J,P)\$ (Q.L(J,P) NE 0)
 =(CHAR.L(ATTRIB,J,P)/Q.L(J,P));
 DISPLAY FINAL;

* Computation of on-tree prices in Florida.

PARAMETER USP(J,P) Price received in US for exports to market j;
 $USP('USA',P) = PR('USA',P) - TR('US',P,'USA');$
 $USP('EU',P) = PR('EU',P)/EUTAR - TR1('US',P,'EU')$(Q.L('EU',P) NE 0);$
 $USP('CAN',P) = PR('CAN',P)/CATAR - TR1('US',P,'CAN')$(Q.L('CAN',P) NE 0);$
 $USP('JAPAN',P) = PR('JAPAN',P)/JPTAR - TR1('US',P,'JAPAN')$
 $$(Q.L('JAPAN',P) NE 0);$

PARAMETER FOBF(P) Weighted product fob price in the US;
 $FOBF(P) = SUM((V,J), USP(J,P) * Y.L('US',V,J,P))/SUM((V,J), Y.L('US',V,J,P));$

PARAMETER FOBFL Weighted average fob price;
 $FOBFL \$ (SUM((V,J,P), Y.L('US',V,J,P) NE 0))$
 $= SUM((V,J,P), USP(J,P) * Y.L('US',V,J,P))/SUM((V,J,P), Y.L('US',V,J,P));$

* Deducting 2 percent Sales Commission and processing cost
 PARAMETER FDELP Florida delivery price i.e. delivered to processors;
 $FDELP = (0.98 * FOBFL - FLPROC);$

DISPLAY USP, FOBF, FOBFL, FDELP;

* Determining an on-tree price for Florida oranges in dollars per box

PARAMETER FONTR(V) Florida on-tree price for variety v;
 $FONTR(V) = FJUCYLD(V) * (FDELP - FLTAX) - FL PICK;$
 DISPLAY FONTR;
 PARAMETER FONTRP0 weighted average on-tree price in current year;
 $FONTRP0 = SUM(V, FONTR(V) * FTP(V) * FUTIL(V)) / FLUTIL;$
 DISPLAY FONTRP0, FONTR;

*Computing prices for Brazil;

PARAMETER BRPTARAD(J,P) Brazil price adjusted for tariff only;
 $BRPTARAD('EU',P) = PR('EU',P)/EUTAR;$
 $BRPTARAD('CAN',P) = PR('CAN',P)/CATAR;$
 $BRPTARAD('JAPAN',P) = PR('JAPAN',P)/JPTAR;$
 DISPLAY BRPTARAD;
 PARAMETER BRP(J,P) Price received in Brazil for exports to market j;
 $BRP('USA',P) = PR('USA',P) - TR1('BRAZIL',P,'USA');$
 $BRP('EU',P) = BRPTARAD('EU',P) - TR1('BRAZIL',P,'EU')$(Q.L('EU',P) NE 0);$
 $BRP('CAN',P) = BRPTARAD('CAN',P) - TR1('BRAZIL',P,'CAN')$(Q.L('CAN',P) NE 0);$
 $BRP('JAPAN',P) = BRPTARAD('JAPAN',P) - TR1('BRAZIL',P,'JAPAN')$
 $$(Q.L('JAPAN',P) NE 0);$

```

DISPLAY BRP;
PARAMETER BEXP(P)  Brazilian exports;
BEXP(P) = SUM((V,J), Y.L('BRAZIL',V,J,P));

PARAMETER FOBBR(P)  Weighted product fob price in Brazil;
FOBBR(P)
= SUM((V,J), BRP(J,P)* Y.L('BRAZIL',V,J,P)/BEXP(P)) $(BEXP(P) GT 0);

PARAMETER FOBB Weighted average fob price in Brazil;
FOBB
= SUM((V,J,P), FOBBR(P)* Y.L('BRAZIL',V,J,P))/SUM((V,J,P),
Y.L('BRAZIL',V,J,P));

* deducting proc cost inland transportation and sales commission
PARAMETERS BRINTP Brazil delivered-in price;
BRINTP = .95*FOBB - BZPROC - BZINLAN;

PARAMETER PB0 Current on tree price in Brazil;
PB0 = BJUCYLD*BRINTP - BZPICK ;

DISPLAY FOBB, PB0;

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BIOGRAPHICAL SKETCH

Arturo Bocardo Valle was born on 7 March 1963, in Veracruz, Mexico. He received a B.A. in economics in 1992 from Universidad Veracruzana (UV). In 1994 he received his Master of Science degree in applied economics from El Colegio de la Frontera Norte (COLEF) in Tijuana, Baja California, Mexico. During his master's thesis research, he accepted an invitation from the University of Calgary in Alberta, Canada where he worked under the guidance of Dr. Elizabeth Wilman, current department head of the Department of Economics in the mentioned university.

In 1994 he joined UV as an assistant professor where he teaches microeconomics and international trade. In 1996 he joined the Ministry of Social Development where he was in charge of implementing several social programs in rural areas in the state of Veracruz.

In fall 1998, he enrolled at the University of Florida to pursue the Doctor of Philosophy degree in the Food and Resource Economics Department. Arturo is currently a candidate for the Doctor of Philosophy degree. He is married to Rosa I. Santos, and they have two children, Alejandra and Adrian.

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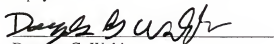
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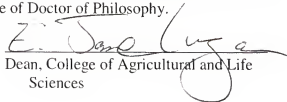
I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.



Douglas G. Waldo
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This dissertation was submitted to the Graduate Faculty of the College of Agricultural and Life Sciences and to the Graduate School and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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